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CONTENTS OF VOLUME XLI

JANUARY, No. 1

Japan—A Land of Natural Disasters.....	WILLARD PRICE	7
Before Magellan.....	JUNIUS BIRO	16
Herbs and Simples—Jungle Style.....	RICHARD C. GILL	29
Pitcairniana	H. L. SHAPIRO	34
The Giraffe and His Living Ancestor.....	EDWIN H. COLBERT	46
Rescuing a Little-Known Chinese Art.....	ANNA G. GRANGER	51
Harvest of the Sea-Floor.....	LEONORA B. ELLIS	62
The Indoor Explorer.....	D. R. BARTON	67
Science in the Field and in the Laboratory.....		70
Your New Books.....		72

FEBRUARY, No. 2

What Are They Thinking?.....	CHARLES R. KNIGHT	85
Your Indoor Desert Garden.....	T. H. EVERETT	93
Natural History for Everybody.....	DONALD CULROSS PEATTIE	103
Depression and Revolt.....	CLARENCE WISSELER	108
How Old Is a Gem?.....	HERBERT P. WHITLOCK	113
If You Died in Old Peru.....		119
The Evolution of Plant Life.....	ALFRED GUNDERSEN & MAUD H. PUROY	126
Tales of Attacks by the Ocean Gladiator.....	E. W. GUDDER	128
Aruba—Cinderella of the Caribbean.....	JUANITA DESBRIERE	138
Millions for Defense.....	HENDRICKS HODGE	141
The Indoor Explorer.....	D. R. BARTON	149
Your New Books.....		152
Science in the Field and in the Laboratory.....		155

MARCH, No. 3

Dark Skies.....	ROBERT CUSHMAN MURPHY	165
The Fastest Hunt in the World.....	C. SUYDAM CUTTING	179
The Enigma of the Squaw-Man.....	CLARK WISSELER	185
The Mystery Dinosaur.....	BARNUM BROWN	190
The Living Dead.....	ERICH M. SCHLAIKER	203
Maple Sugar Time.....		212
The Story of Spices.....	VIRGINIA S. EIFERT	214
The Indoor Explorer.....	D. R. BARTON	224
Your New Books.....		228
Science in the Field and in the Laboratory.....		234

APRIL, No. 4

The Highest Mountain Ever Climbed.....	ARTHUR B. EMMONS, 3rd	245
Lichens in Your Rock Garden.....	RAYMOND H. TORREY	265
Sitting with the Indian Judges.....	CLARK WISSELER	271
Flowers as National Emblems.....	NATALIE HARLAN DAVIS	275
A Ticket to the Arctic.....	RICHARD FINNIE	282
The Rarest American Spruce.....	C. EDWARD GRAVES	294
The Indoor Explorer.....	D. R. BARTON	299
Science in the Field and in the Laboratory.....		303
Your New Books.....		305

MAY, No. 5

Green Gold.....	R. NEUMANN LEFEBVRE	325
Sun-Spots in the News.....	WM. H. BARTON, JR.	344
The Story of Amber.....	WILLY LEX	351
The Face of Peking Woman.....	FRANZ WEIDENREICH	358
A Round Trip to Davy Jones' Locker.....	WM. H. HANG, JR.	361
Native Life in New Guinea.....	NASH NEJAME	363
Exploring New Cave.....	R. M. P. BURNET	374
The Indoor Explorer.....	D. R. BARTON	385
Your New Books.....		388
Science in the Field and in the Laboratory.....		392

INDEX TO VOLUME XLI

TEXT AND ILLUSTRATIONS

Names of Articles Are Set in Capitals and Small Capitals

Akeley, Mary L. Jobe, 70

ARUBA—CINDERELLA OF THE CARIBBEAN, Juanita DesBriere, 138-140

Astronomy:

- Amateur Astronomers, 71, 234, 303
- Hayden Planetarium, 71
- Junior Astronomy Club, 303

Barton, D. R.: The Indoor Explorer, 67-69; 149-151; 224-227; 299-302; 385-387

Barton, Wm. H., Jr.: Sun-Spots in the News, 344-350

BEFORE MAGELLAN, Junius Bird, Illustrated, 16-28

Bennett, Wendell C., 155

Bird, Junius: Before Magellan, 16-28

Birds:

- American Ornithologists' Union, 71
- Dept. of, 68
- Habitat Group, 71
- Walks, 303

Bliss, Robert Woods, 156

Bogert, C. M., 392

Books:

- Adventures of a Bird Watcher*, 156
- American Indian*, The, 305
- Americans in Process*, 72
- America's Yesterday*, 228
- Anatomy of the Frilled Shark*, The, 309
- Animal Treasure*, 305
- Animals and Men*, 152
- Arctic Harpooner*, 312
- Ascaris: The Biologist's Story of Life*, 74
- Atlantic Game Fishing*, 389
- Audubon the Naturalist*, 307
- Australia's Entail*, 308
- Axial Bifurcation in Serpents*, 309
- Birds Against Men*, 388
- Birds of America*, The, 73
- Birds of Tropical West Africa*, The, 310
- Bird Studies of Old Cape May*, 311
- Beyond Horizons*, 390
- Call of the Koala*, The, 312
- Cats & Cats*, 75
- Chinese Ceramic Glazes*, 313
- Danger Is My Business*, 307
- Daylight Moon*, 74
- Diary of a Surgeon*, The, 153
- Early Man*, 306
- Earth-Lore*, 230
- Edward Wilson: Nature-Lover*, 230
- Exploring as a Career*, 308
- Exploring the Heavens*, 74
- Garden in Color*, The, 153
- Gardening Indoors*, 308
- Genetics and the Origin of Species*, 154
- Giant Fishes, Whales and Dolphins*, 311
- Hawaii*, 229
- Hawaiian Tapestry*, 229
- Herd of Red Deer*, A, 154
- History of the Business Man*, A, 310
- How to Know People by Their Hands*, 307
- Human Value of Biology*, The, 306
- I Find Australia*, 154
- Invasion of China by the Western World*, 388
- Island of Bali*, The, 152
- Koala*, 312
- Lady and the Panda*, The, 231
- Let's Go to the West Indies*, 390
- Life Story of the Fish*, The, 389
- London Zoo*, The, 228
- Making Pictures with the Miniture Camera*, 170
- Map Makers*, 75
- Mexican Interlude & Notes on a Dream*, 153
- Milestones in Medicine*, 308
- Naturalists of the Frontier*, 229
- Nature Photography Around the Year*, 307
- Over the North Pole*, 231
- Poignant of the Heavens*, The, 231
- Prairie Grove*, A, 311
- Science and Music*, 73
- Sod-House Frontier*, The, 73
- Some Globe-Trottings with a Rod*, 389
- Spotted Lion*, The, 153
- Story of Alaska*, The, 390
- Story of 20th Century Exploration* The, 306
- Sunspots and Their Effects*, 72
- Swift Movements in the Trees (and at Their Roots)*, 74
- These Are the Virgin Islands*, 390
- This Is Our World*, 312
- Tombs, Travels, and Trouble*, 230
- Wardens of the Wild*, 312
- Ways of Birds*, 75
- World in Maps*, The, 230
- World Natural History*, 388
- Brown, Barnum, The Mystery Dinosaur, 190-202
- Burden, W. Douglas, 70, 303
- Burnet, R. M. P.: Exploring a New Cave, 374-383
- Carter, T. Donald, 304
- Chapman, Frank M., 68, 71
- Chubb, S. Harmsted, 224-227; 234
- Colbert, Edwin H.: The Giraffe and His Living Ancestor, 46-50
- Cutting, C. Suydam: The Fastest Hunt in the World, 179-184
- DARK SKIES, Robert Cushman Murphy, Illustrated, 165-178
- Davis, Natalie Harlan: Flowers as National Emblems, 275-281; 93-98
- deLong, Mrs. George B., 71
- DEPRESSION AND REVOLT, Clark Wissler, 108-112
- DesBriere, Juanita: Aruba-Cinderella of the Caribbean, 138-140
- Dibbren, Arthur H., 71

Education:

 - Courses, 155
 - Dept. of, 156, 240
 - School Nature League, 392

- Eifert, Virginia S.: The Story of Spices, 214-222
- Ellis, Leonora B.: Harvest of the Sea-Floor, 62-66
- Emmons, Arthur B., 3rd: The Highest Mountain Ever Climbed, 245-264
- ENIGMA OF THE SQUAW-MAN, THE, Clark Wissler, 185-189
- Everett, T. H.: Your Indoor Desert Garden, 93-102
- EVOLUTION OF PLANT LIFE, THE, Alfred Gundersen & Maud H. Purdy, Illustrated, 126-127

Expeditions:

 - American Museum-Sinclair 1937, 190
 - British-American Himalayan, 245
 - For Invertebrates, 155
 - In Bolivia & Peru, 155
 - On Baile Colorado, 155
 - Phelps Venezuelan, 155, 393
 - Snyder East African, 303
 - Terry-Holden, 392
 - Vernay-Kaffrarian, 234, 304
 - Whitney, 155

INDEX TO VOLUME XL1

EXPLORING A NEW CAVE, R. M. P. Burnet, Illustrated, 374-383

FACE OF PEKING WOMAN, THE, Franz Weidenreich, Illustrated, 358-360

FAIREST HUNT IN THE WORLD, THE, C. Suydam Cutting, Illustrated, 179-184

Finnie, Richard: A Ticket to the Arctic, 282-292

Fisher, Clyde, 392

FLOWERS AS NATIONAL EMBLEMS, Natalie Harlan Davis, Illustrated, 275-281

Fry, Gladys Gordon, 303

George Comer Memorial, 234

Gill, Richard C.: Herbs and Simples—Jungle Style, 29-33

Gilliard, Thomas, 155

GIRAFFE AND HIS LIVING ANCESTOR, THE, Edwin H. Colbert, Illustrated, 46-50

Granger, Anna G.: Rescuing a Little-Known Chinese Art, 51-61

Graves, C. Edward: The Rarest American Spruce, 294-297

GREEN GOLD, R. Neumann Lefebvre, Illustrated, 325-343

Gudger, E. W.: Tales of Attacks by the Ocean Gladiator, 128-137

Gundersen, Alfred: The Evolution of Plant Life, 126-127

Hand, Wm. H. Jr.: A Round Trip to Davy Jones' Locker, 361

HARVEST OF THE SEA-FLOOR, Leonora B. Ellis, Illustrated, 62-66

HERBS AND SIMPLES—JUNGLE STYLE, Richard C. Gill, 29-33

HIGHEST MOUNTAIN EVER CLIMBED, THE, Arthur B. Emmons, 3rd, Illustrated, 245-264

Hodge, Hendricks: Millions for Defense, 141-148

Holden, William H., 392

HOW OLD IS A GEM? Herbert P. Whitlock, Illustrated, 113-118

IF YOU DIED IN OLD PERU, Illustrated, 119-125

INDOOR EXPLORER, THE, D. R. Barton, Illustrated, 67-69; 149-151; 224-227; 299-302; 385-387

JAPAN—A LAND OF NATURAL DISASTERS, Willard Price, Illustrated, 7-15

Knight, Charles R.: What Are They Thinking?, 85-92

Lefebvre, R. Neumann: Green Gold, 325-343

Ley, Willy: The Story of Amber, 351-357

LICHENS IN YOUR ROCK GARDEN, Raymond H. Torrey, Illustrated, 265-270

LIVING DEAD, THE, Erich M. Schlaikjer, Illustrated, 203-211

Mammals:

- Animal art, 85-92
- Buffalo, 155
- Cheetah, 179-184
- Giraffe, 46-50
- Insectivores, 201-211
- Okapi, 46-50

Man:

- Alacalufs, 18
- American Indians, 108-112; 185-189; 271
- Canoe Indians, 28
- Ecuadorians, 29-33
- Flatheads, 155
- Foots, 28
- Guaranis, 138
- Pitcairnians, 34-45
- Sherpas, 249

MAPLE SUGAR TIME, Illustrated, 212-213

McConnell, Robert E., 155

MILLIONS FOR DEFENSE, Hendricks Hodge, Illustrated, 141-148

Miner, Roy Waldo, 68-69, 155

Murphy, Robert Cushman: Dark Skies, 165-178; 70; 392

MYSTERY DINOSAUR, THE, Barnum Brown, Illustrated, 190-202

NATIVE LIFE OF NEW GUINEA, Nash Nejame, Illustrated, 363-373

NATURAL HISTORY FOR EVERYBODY, Donald Culross Peattie, Illustrated, 103-107

Nejame, Nash: Native Life of New Guinea, 363-373

Noble, G. Kingsley, 303

Peattie, Donald Culross: Natural History for Everybody, 103-107

Peruvian Mummy, 71

Phelps, William, Jr., 155

PITCAIRNIANA, H. L. Shapiro, Illustrated, 34-45

Price, Willard: Japan—A Land of Natural Disasters, 7-15

Procter, William, 156

Purdy, Maud H.: The Evolution of Plant Life, 126-127

Ramsey, Grace F., 240

RAREST AMERICAN SPRUCE, THE, C. Edward Graves, Illustrated, 294-298

RESCUING A LITTLE-KNOWN CHINESE ART, Anna G. Granger, Illustrated, 51-61

Rockwell, Robert H., 155

ROUND TRIP TO DAVY JONES' LOCKER, A, Wm. H. Hand, Jr., 361

Russell, Charles, 156

Scheuerle, Joe, 71

Schlaikjer, Erich M.: The Living Dead, 203-211

Shapiro, H. L.: Pitcairniana, 34-45

SITTING WITH THE INDIAN JUDGES, Clark Wissler, 271-274

STORY OF AMBER, THE, Willy Ley, Illustrated, 351-357

STORY OF SPICES, THE, Virginia S. Eifert, Illustrated, 214-222

SUN-SPOTS IN THE NEWS, Wm. H. Barton, Jr., Illustrated, 344-350

Synthetic Emeralds, 234

TALES OF ATTACKS BY THE OCEAN GLADIATOR, E. W. Gudger, Illustrated, 128-137

Tate, G. H. H., 155, 393

TICKET TO THE ARCTIC, A, Richard Finnie, Illustrated, 282-292

Torrey, Raymond H.: Lichens in Your Rock Garden, 265-270

Van Name, Willard G., 155, 393

Weidenreich, Franz: The Face of Peking Woman, 358-360

WHAT ARE THEY THINKING? Charles R. Knight, Illustrated, 85-92

Whitlock, Herbert P.: How Old Is a Gem? 113-118; 68

Wissler, Clark: Depression and Revolt, 108-112; Sitting with the Indian Judges, 271-274; The Enigma of the Squaw-Man, 185-189

YOUR INDOOR DESERT GARDEN, T. H. Everett, Illustrated, 93-102



January

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The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

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VOLUME XLI—NO. 1

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JANUARY, 1938

Giraffes	Cover Design
<i>From a drawing by Else Bostelmann</i>	
Old Eskimo Man.....	Frontispiece 6
Japan—A Land of Natural Disasters.....	Willard Price 7
<i>Earthquakes, tidal waves, volcanic eruptions and storms in the Land of Cherry Blossoms</i>	
Before Magellan.....	Junius Bird 16
<i>Explorations of an archaeologist and his wife in a 19-foot sailboat</i>	
Herbs and Simples—Jungle Style.....	Richard C. Gill 29
<i>It's better to be on the good side of the witch doctor</i>	
Pitcairniana	H. L. Shapiro 34
<i>Sequel to the mutiny of the Bounty</i>	
The Giraffe and His Living Ancestor.....	Edwin H. Colbert 46
<i>A fossil living 15 million years behind the times</i>	
Rescuing a Little-Known Chinese Art.....	Anna G. Granger 51
<i>A fascinating style of peasant embroidery</i>	
Harvest of the Sea-Floor.....	Leonora B. Ellis 62
<i>Sponge gathering by the largest unmixed Greek community in America</i>	
The Indoor Explorer.....	D. R. Barton 67
Science in the Field and in the Laboratory.....	70
Your New Books.....	72

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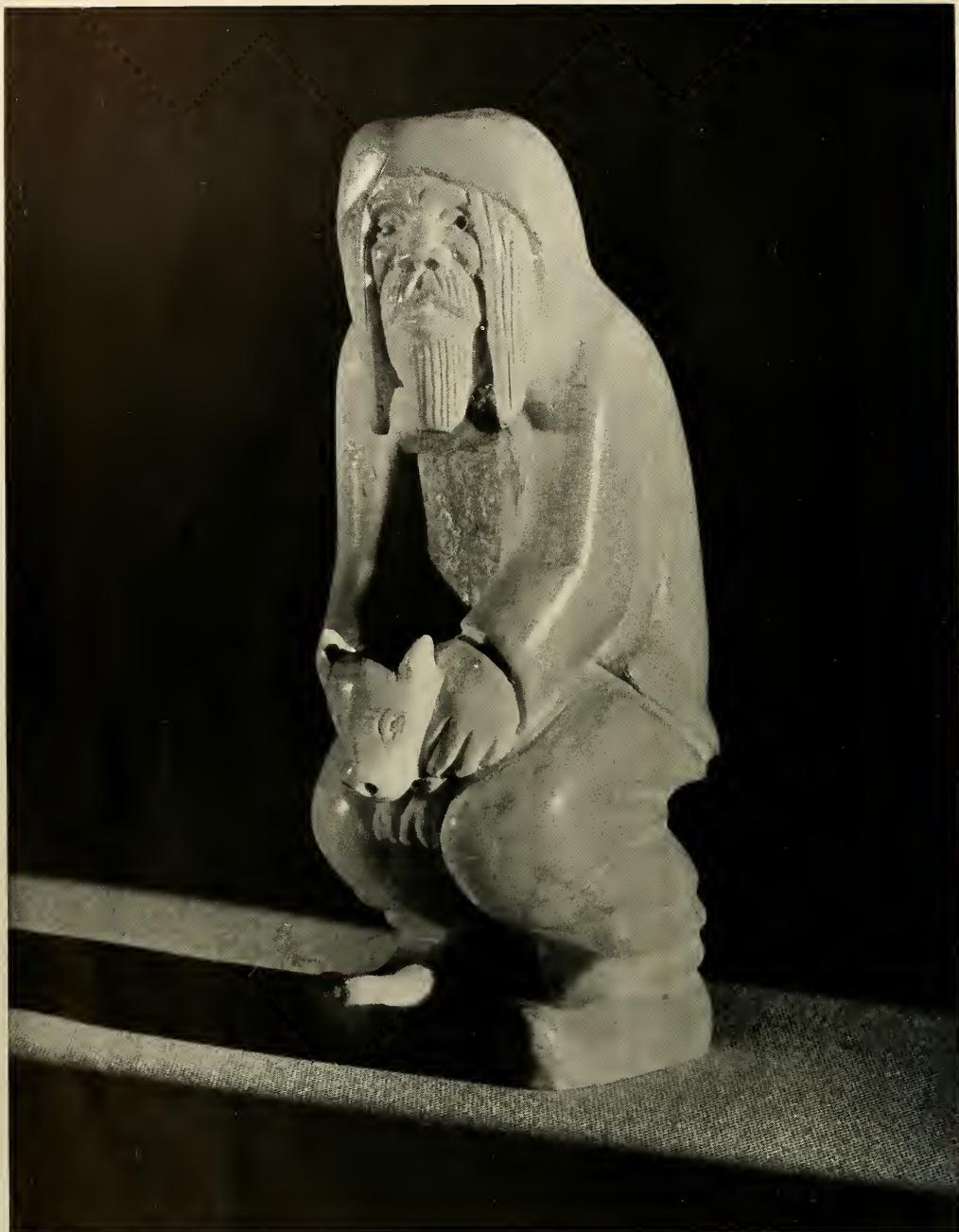


Photo by Charles H. Coles, AMNH

ESKIMO MAN IN IVORY

A NATIVE CARVING from West Greenland, illustrating the primitive artistic skill of a people long used to working in walrus ivory and bone in the making of their implements

The example is from a collection recently presented to the American Museum by the former United States Minister to Denmark, Ruth Bryan Owen (Mrs. Borge Rohde)

JAPAN—A LAND OF NATURAL DISASTERS—Earthquakes, tidal waves, volcanic eruptions and storms in the Land of Cherry Blossoms contribute toward a twofold national personality—aesthetic and indomitable

By WILLARD PRICE

I WISH there would be an earthquake!" says the new arrival in Japan. He soon has his wish. "Not had at all," he comments, greatly pleased with the novel rocking sensation.

The second one does not please him quite so much. The third makes chills go up and down his spine. The fourth brings out the gooseflesh. He thinks, "I wish they would stop that."

But there is no way to stop an earthquake. And the newcomer's increasing uneasiness is due to his growing realization that there is nothing he can do about it, that this is something beyond his control. There is no way of telling whether the shock will be trivial or fatal. Perhaps only a vase will fall from a shelf. Perhaps the house will collapse and kill all the inmates.

This is a land of the unpredictable and unexpected. It is in a peculiar sense in the lap of the gods. And they are nervous gods—trembling, stormy, explosive.

A land born of violence

Japan is probably more seriously troubled by seismic and volcanic outbursts than any country its size in the world. It derives much of its physical character, almost its very existence from these agencies. Geological changes that otherwise require many thousands of years occur there with shocking suddenness. An island along the seacoast has been known to be joined to the mainland in a single volcanic eruption. Even the usually imperceptible changes in level of coast are here constantly appreciable, upward on the east and downward on the west.

According to Japanese legend, Fuji and her lesser companions rose in a night. According to geology, it took far longer than that. But according to anyone's casual investigation it is plain that the upheaval was tremendous. Japan is 85% mountainous,

and two dozen of its mountains are between 8000 and 12,000 feet high.

The extent of the subterranean reservoirs of molten rock that lie beneath the surface of the island cannot be accurately estimated; but 54 of her 192 volcanoes are now active or only recently extinct. There are nearly 1000 hot springs. There are about four earthquakes a day, a strong earthquake on the average of once a month, a disastrous shock every lifetime. Tidal waves often follow the quakes, as in the disaster of March 3, 1933, when a wave swept 300 miles of the coast and engulfed 1400 houses. Typhoons are frequent; also conflagrations.

Goddess of Fire

Fuji, though she has been dormant since 1707 and is a sight of beauty in her robe of virginal white, may prove herself again a devil at heart. The fires still burn below, and bursting forth of other volcanoes in the region gives evidence that a long quiescent crater may at any time break into disastrous activity. Fuji has been constituted a Shinto shrine, and thousands of pilgrims climb it yearly to beseech the spirit of the mountain to have mercy. The name Fuji is an aboriginal Ainu word with two meanings, "Goddess of Fire" and "to burst forth." In either sense the name is appropriate.

The majestic cone, 12,400 feet high, has the shape of a perfect ant-hill, and, like an ant-hill, was formed by material forced out from beneath. Its most recent great eruption was described by the priest whose temple stood at the base: "Fuji-no-yama suddenly opened in a place overgrown with splendid trees to vomit fire. . . . Showers of stones and ashes lasted for ten days, so that fields, temples, houses, were covered with ejected matter more than ten feet deep. The dwellers in the neighborhood of Fuji lost their homes and many of them died of hunger."

Today only steam spurts from holes in the crater's rim; pilgrims cook their eggs in the jets. But Fuji

may become weary of speaking only by proxy, through the mouths of other volcanoes. The people fear her, knowing well how dormant or supposedly extinct volcanoes suddenly throw off all reserve . . . How Bandai in 1888, for example, roused from a thousand-year sleep to blow off her snow cap and kill four hundred persons.

So the Goddess of Fire, who is supposed to sit in the white-hot center of the snowy cone, is worshiped more devoutly than any other deity in Japan with the exception of Amaterasu, the Sun-Goddess. Contrarily, the Sun Goddess is besought to bring heat, while her subterranean sister is begged to withhold it.

Of the 54 active volcanoes, Asama has been most vicious of late. For five years she has been greatly disturbed and seems to be preparing for a major catastrophe. The crater is boiling furiously, now and then spurting streams of red-hot lava. Showers of incandescent rocks kill many climbers. Ashes and cinders pour down upon the roofs of houses twenty miles away and the violent quakes make life uneasy in the nearby resort, Karuizawa, where British and American residents of Japan spend their summers. The volcano is twice as high as Vesuvius, has a more deeply buried Pompeii near its base, and a greater record of activity.

Forty-eight villages buried

Asama means "Without Bottom" but the name is a misnomer. The crater's bottom may now be seen at a depth of six hundred feet, and is steadily rising. This gradual filling of a crater is usually a prelude to a major eruption, and seismologists have already given warning that the catastrophe of 1783 may soon be repeated. At that time 48 villages were buried a hundred feet deep by a great river of boiling lava. The river then cooled and hardened, and today you may walk a hundred feet above the houses and the bodies of the victims, forever imprisoned below.

I climbed Asama and shall not soon forget the experience. Not that the climb would be difficult to the hardened mountain-climber—but the fact that it must be made at night, and that the trail is easily lost, and that the mountain gives constant promise of annihilating the human midget, lends spice to the adventure.

Being ignorant of the way, I attached myself to a group of Japanese students—but soon found that they were no wiser. We were soon quite off the trail, clambering up through lava boulders, and skidding in cascades of cinders. While escaping the day's heat, we encountered a chill night fog. It drenched us so thoroughly that we could wring the water from our clothes. The darkness was profound,

illuminated only by the occasional flash of an electric torch. The fog smothered even this, and the light of a climber fifty feet away could not be seen.

Now and then we would climb out of a cloud. It lay below us against the mountain side like a sea against a shore. Roofing us was another sea and into it we would climb.

Dawn found us fog-bound, lost, and shaking with cold. We huddled in the lee of a big rock, the swift, cold tide of cloud sweeping by us. The rumbling mountain had taken to hurling out red-hot stones which went sizzling through the liquid air above us. This should have been terrifying, but in our chilled condition the thought of being struck by a few hot stones was not altogether unpleasant. From our pockets we collected scraps of paper, made a small fire, and warmed our cramped hands.

Where to go? The obvious answer would seem to be "Up!" But Asama is not a cone, and the top of the mountain consists of miles of hills. Therefore, the way to the crater is quite as likely to be down as up.

Vulcan's workshop

Suffice it that we found it. We came suddenly to an abrupt brink and looked down into a cloud-filled void. We could see nothing, imagine anything. A deafening roar smote us. Down there a titan was hurling hills, tossing up skyrockets made of incandescent boulders, splashing about in his morning bath of boiling lava. Or was it the sound of a thousand trains going over a thousand bridges? There was also a fluid note in the tumult, reminding one of Niagara Falls—but the fluid in this case was liquid rock. Again, it could be a foundry, Vulcan's workshop, but equipped with all the most ear-splitting modern machinery. What grinding, gritting, bursting, rending! One of the students spoke to me. I could see his lips move but could not hear his voice.

Belches of sulphurous smoke seared our eyes, made us gasp for air. The changing wind would at one moment cook us in hot steam, then chill us with a cold fog.

We scattered, lost to sight instantly, each bent on some bit of exploration along the rim. There were nine of us . . . when we came together again there were only eight.

One had seen it happen.

"He left this letter," he said when we had descended to a spot of comparative quiet.

The letter was to the boy's mother. We did not open it, but his fellow-students could guess the message.

"School was pretty hard for him," they said.



Ewing Galloway

EARTH

(Below) CRACKS in a city street caused by a recent earthquake. From 1923 to 1933 there were 21,845 shocks strong enough to be felt

Willard Price



(Below) TOKYO 1923: the worst natural catastrophe in all history, which destroyed nearly half of the third largest city in the world and all of Yokohoma

Wide World



A LANDSLIDE in southern Japan which paralyzed traffic and caused severe property damage and suffering to those who lost their homes

Wide World



(Above) TEMPLE LANTERNS in Tokyo overturned by earthquake. A strong quake a month is Japan's average

FROM EARTH and sky and by fire and flood, Japan is probably more sorely harassed by natural disasters than any other country her size in the world



AIR

Wide World Photos

JUNKS that were junked by a typhoon: evidence of a \$150,000,000 natural disaster which swept western Japan a few years ago killing over 1500, among them 500 school children



(Left) WATERFRONT DESTRUCTION in Osaka following the same typhoon. In a more recent typhoon trains were overturned by the 130-mile-an-hour wind, 8000 ships and boats were sunk, 300 schools destroyed, 100,000 homes flooded and 3000 persons killed. The property loss was \$300,000,000.

Wind means fire. The glow of a forgotten coal becomes the holocaust of a wood-and-paper Japanese city



Floods, tidal waves, and typhoons drown 600 a year. (Left) Flight by night from a flood in Tokyo which made 20,000 homeless



Wide World

(Above) TOKYO, normally one of the driest spots in Japan, flooded by a series of typhoons and a month of rainy weather. Tokyo has a rainfall more than twice that of London

WATER

A STREET in Osaka flooded by typhoon. In rural districts salt water is sometimes carried up onto the land so far as to ruin the productivity of thousands of acres

Photo from Willard Price and The Tokyo Asahi

JAPAN—A LAND OF NATURAL DISASTERS

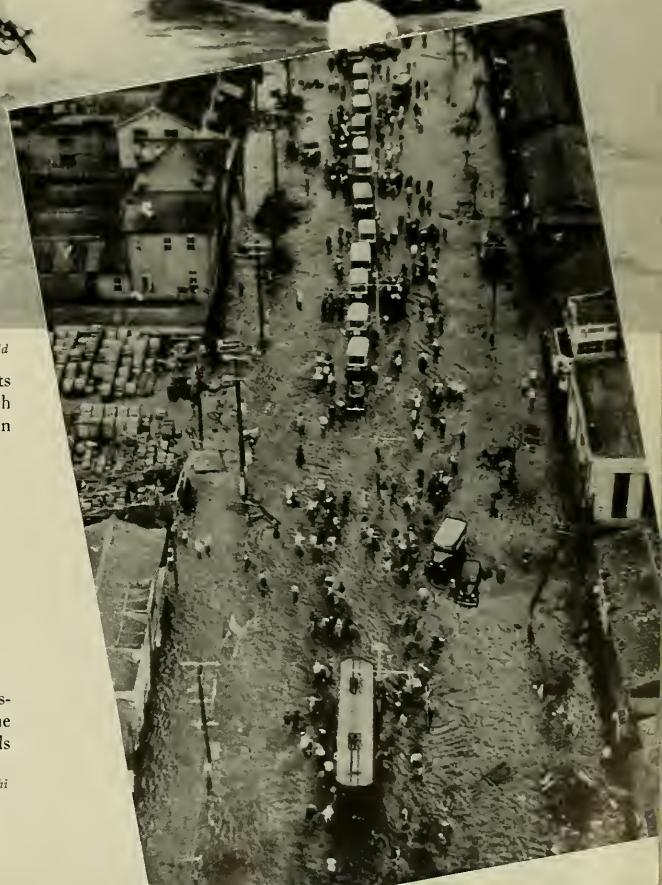




Photo from Willard Price and the Japanese Government Railways

(Above) ONE of the *jigoku* or therapeutic "hells" of Beppu, with a realistic statue of his satanic majesty

(Right) FIRE-CLOUD above Komagatake, June 1929. Volcanic eruptions and earthquakes are a serious cause of fires

FIRE

(Below) ONE OF FOUR HOUSES left standing in Kinosaki after quake and fire

European Photo

JAPAN has 18,000 fires a year, destroying 20,000 houses. In certain parts of Tokyo it used to be taken for granted that the average house would survive only three years.

Modern fire-fighting equipment has changed that, but the toll remains high. The most recent serious fire, in Hakodate, took 2000 lives and left 150,000 homeless

Photo from Willard Price and The Tokyo Asahi



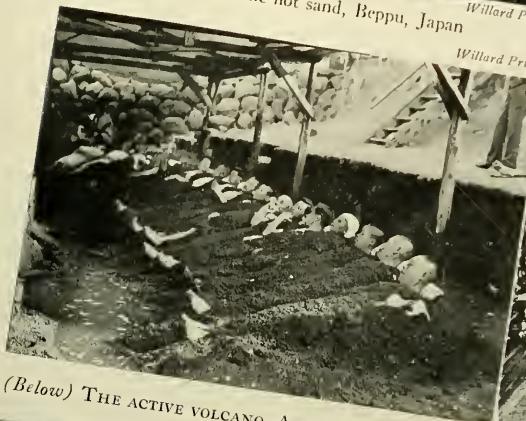


THE JAPANESE do not get used to earthquakes or forget their 192 volcanoes, 54 of which are active. Mr. Price writes "Disaster in one form or another as the daily food of Japan has bred a stoical, bullheaded people who know how to fight because they have had a hard drillmaster, Brute Nature. There is also a Mother Japan, gentle, lovely, artistic to a high degree"

(Left) MT. ASO, JAPAN

(Below) BAKING in the hot sand, Beppu, Japan

Willard Price



Willard Price

(Below) THE ACTIVE VOLCANO, Asama

Willard Price



(Below) BOILING EGGS at Nature's expense

Willard Price



European Photo

TOKYO, four years after the earthquake of 1923. "Shikata ga nai (It can't be helped)," says Japan, and rebuilds



Even when one knows that there are three volcano-suicides in Japan every day of the year it is a shock to have one come within close range. At least it is a shock to the foreigner—but to the Japanese, suicide is an orderly and recognized procedure, and my companions were only a little quiet as we went down the mountain. We went rapidly, for the titan did not seem to have been appeased by the pathetic human sacrifice, and we did not forget that six descending pilgrims had been hurried into eternity only a few days before by a volley of hot stones. Another had been caught on an island in a stream of lava . . . the island became smaller until the glowing river kindled his clothing.

Many of Japan's most vigorous volcanoes are on islands. Miura, a few hours' boat ride from Tokyo, is a favorite suicide resort. Sakurajima smokes as a constant reminder of its most brilliant achievement, the burying of a whole town of ten thousand people. Mount Niidake recently trapped on its tiny island a party of scientists who came to investigate it. The flanks of Uracas, a cone which rises abruptly out of the sea, often gleam at night with streaming lava, and ashes strew the decks of passing steamers.

Disappearing islands

Other volcanic islands rise out of the sea, stay long enough to collect a few inhabitants then sink. Near San Agostino an island two and a half miles in circumference rose in 1904 and disappeared in 1906. Smaller islands frequently pop up, get themselves onto a chart, then mock the chart by vanishing. South of the Ogasawara Islands there are many submarine volcanoes which at times capsizes schooners by their sudden explosions, spewing up great rocks, and leaving nothing at last but a few floating spars and the stench of sulphur.

There is one profitable by-product of Japan's volcanic energy—the hot spring business. Thousands of hotel-keepers have reason to thank the fiery gods responsible for 954 hot springs to which bathers make pilgrimage by the hundreds of thousands. These springs are of many sorts, simple thermal, carbon-dioxide, alkaline, salt, bitter, iron, vitriolic, sulphur, radio-active. Farmers near spas use warm water in their fields, thus hastening growth; others economize on manure by fertilizing with water from ammonia springs.

The city of Beppu has steam heat. Live steam is diverted into the stoves for cooking purposes. There are hundreds of *jigoku* or "hells" where one may enjoy boiling himself in bubbling mud. Even the sand of the sea-beach is steaming hot and one witnesses the remarkable spectacle of thousands of hu-

man heads projecting from the beach. The bodies are baking below.

Less spectacular perhaps than the volcanoes, but more deadly are the earthquakes. The earthquake of 1923 earned distinction as the greatest natural catastrophe of all history. Over a third of Tokyo, the third largest city in the world, was destroyed by the quake and ensuing fires, and all of Yokohama. Official figures disagree as to the number of lives lost, the estimates ranging between 96,000 and 157,000. There was far too much confusion to make an accurate count possible. It is known that in a single square in Tokyo 33,000 people were turned by the holocaust into 150 cubic feet of ashes; an Earthquake Memorial Temple built upon the spot now enshrines the ashes.

The world's worst earthquake

On that fateful day there were 222 shocks between noon and midnight. A Japanese friend tells me, "So much dust was jarred out of the walls into the room that I couldn't breathe. I ran out and climbed a tree. Foolishly, I tried to count the other trees in the yard. But I couldn't tell whether there were four or five—they were moving so fast."

The earth split and burst. People in the country ran to the shelter of bamboo thickets—for the bamboo roots go deep and inter-tangle in such a way as to hold the earth together. But it was necessary to crouch low, for the trees beat together, sometimes flailing each other into kindling wood. The quake upset kitchen fires—the cities were soon in a blaze. Thousands fled to the shore of the Sumida River. Other thousands came behind them. The fire followed, and the struggling mass was pushed over into the river.

There was occasional comedy relief. The walls of the Grand Hotel fell away and exposed a lady in her bath on an upper floor. She gesticulated wildly but would not step out of the tub; young gallants climbed up and rescued her, tub and all.

Thousands who did not lose their lives lost everything else. There were estimated to be three million sufferers in all.

Japan outstrips Italy, her nearest competitor, in number and violence of earthquakes. During the ten years following 1923 there were 21,845 quakes strong enough to be felt—besides tens of thousands detected only by the seismograph. The death toll is heavy, the nerve toll heavier. The Japanese do not become used to earthquakes; they heartily dislike and fear them.

What causes earthquakes? Their extreme frequency in Japan results largely from two circum-

stances: the volcanic nature of the islands and the abruptly sloping eastern coast which drops in gradients of 1 in 27 and 1 in 16 into one of the deep spots in the Pacific, Tuzcarora Deep, almost five miles below the surface. Steep slopes of this sort are conducive to crustal instability, and many of Japan's earthquakes result from slipping or faulting of submarine beds of rock. These shocks are apt to be much greater than those which are caused by underground volcanic activity, in which the disturbance seldom extends beyond an area of 100 or 200 square miles and is intense chiefly near the center.

Prediction of earthquakes

If earthquakes cannot be bridled can they at least be foretold? Japanese seismologists have naturally given more study to this problem than scientists elsewhere, and they are now having a fair measure of success in predicting earthquakes in specific localities several months in advance by recording changes in terrestrial magnetism. But there are still plenty of surprises to lend spice to life in Japan.

When disaster does not come from below it comes from above. Rain is the angel and devil of Japan. It makes crops grow with unexampled speed, but it annually causes devastating floods. Rain has made "peaked deserts" of many mountains, despite the efforts of reforestation men, and down these bare slopes rush deluges which swell rivers, sweep away bridges, flood the country, make thousands foodless and homeless. Floods, together with tidal waves and typhoons, drown 600 a year. Even Tokyo, one of the driest spots in Japan, has more than twice the rainfall of London. In the western mountains, winter snow forms to a depth of eighteen feet, covering the low houses so that tunnels must be dug down to the doorways. This snow melts in spring with dire results. Flood control is expensive—even the wealth of the United States has not accomplished it—and Japan feels compelled to spend upon her army the money that, in a more peaceful world, might be devoted to controlling the rashness of nature.

What the malicious gods above cannot do with rain, they accomplish with wind. Wind means fire. The glow of a forgotten coal becomes the holocaust of a city. Japanese cities are built of wood, favorite food of fire. Japan has 18,000 fires a year, destroying 20,000 houses. In certain parts of Tokyo it used to be taken for granted that the average house would survive for only three years. Modern fire-fighting equipment has changed that . . . but still there are city plans drawn up for new thoroughfares, fatalistically awaiting the inevitable fires that will open the way for their execution. The most recent serious

fire was that in Hakodate three years ago, taking two thousand lives and leaving 150,000 people homeless. Japan's most haunting fire fear is of the burning of her wood-and-paper cities by incendiary bombs dropped from Soviet airplanes which could readily make the short flight from the nearby Soviet stronghold, Vladivostok.

Earthquakes and fire affect chiefly the cities; they do little damage to the farms. The typhoon is impartial. It destroys all alike. Overtaken by the typhoon of September, 1934, I took shelter in a farmhouse. The family consisted only of a young man and his two sisters. Their parents had died of ailments brought on by malnutrition during a severe drought a few years before.

This young man had inherited the farm. It was evident from the way he spoke of it that he took great pride in it and had slaved to make it a success. And now he was to see all his work wiped out in one night.

Relentless Nature

We lay in the floor-beds but could not sleep. The house shook as with the ague. A hot wind, straight from the South Seas, and loaded with salt, blew into the rooms in spite of the fact that the shutters were tightly closed. Through unsuspected cracks it brought in dirt, leaves and sticks from the flying confusion without. Trees fell, heavy tiles crashed from the roof, timbers torn from collapsing houses struck the shutters. But the house stood.

The farm, however, was ruined. When at dawn we opened the shutters a crack and looked out, the farm had disappeared. Where it had been, there was now a sea. This had been caused, not by the downpour, but by the backing up of a river under the force of a tidal wave. That is, the wind had carried the ocean up upon the land. In many cases the rivers flowed backward for a distance of two or three miles and deluged thousands of acres with salt water. It would be weeks before the moisture would drain away or evaporate, and then the soil would be left heavily impregnated with salt and sand, spoiling its fertility for years. Certainly there would be no more food from this farm for a long time.

The answer to such a problem is to sell the girls to the agents of licensed quarters. These agents are always early on the scene after a rural disaster. One appeared on the morning in question—but he got no satisfaction. He and his kind did better elsewhere, and an investigator a few weeks later found that in many of the stricken villages no girls of teen age were left. In the Japanese conception, the girl who thus sacrifices herself that her family may eat merits great honor.

Continued on page 80

BEFORE MAGELLAN—*The explorations of an archaeologist and his wife in a 19-foot sailboat; the story of ancient man in South America reconstructed and the myth of the prehistoric sloth's domestication discounted*

By JUNIUS BIRD

*Staff Assistant in Anthropology,
American Museum*

COLUMBUS, Magellan, Cabot, Parry; start with the Norsemen if you will, list all the explorers you can think of who have added to our knowledge of the Americas, yet you will find few, very few, who have stood where no man stood before. From North Greenland to Cape Horn the land was known to men for many generations. What counts even more, they took with them their women and children and settled most of it.

Who were the real explorers and settlers? When and from where did they come, and how did they live? These are the questions which are bound to grow in your curiosity if you find yourself as did Mrs. Bird and I, during a 1300-mile journey in a 19-foot sailboat, exploring a little known section of southernmost South America where some of the answers lay literally underfoot.

One wonders how the world was to these early, primitive explorers in farthest South America; whether climatic conditions were different from today and whether they knew animals unlike those of the present. In our searches, for instance, we found traces of the giant ground sloth. This creature has the unique distinction of being perhaps the only prehistoric animal that has ever been hunted for with firearms, for at least one expedition was led in the hope of discovering the ground sloth alive. Modern man has never seen it and never will, but it left interesting evidence for us of its being known to primitive man at the dawn of recent times, as will be shown later.

JUNIUS BIRD has the unique record at 30 of having engaged in six expeditions to various parts of the Arctic, three to South America, and one to the Caribbean Sea. His talent for archaeology and his exceptional resourcefulness as an explorer have been produc-

tive of valuable information on the history of primitive man in North and South America. His knowledge of sailing and navigation, essential to the success of the expedition described here, is derived from his many seasons on *The Morrissey* under Captain Bob

Bartlett. Navigating in the Caribbean in 1931 he weathered a severe hurricane in which his vessel was one of the two boats out of sixteen in the vicinity which remained afloat. Mrs. Bird accompanied her husband on one previous expedition, to Labrador.—THE EDITOR.

Almost everyone has a general knowledge of the early European exploration and settlement of America, and detailed information is available in every library. Yet think how difficult it would be if you had to reconstruct the story several thousand years from now with no written records to refer to. The potsherds, bottle glass, gun flints, and metal objects left would give only a vague story of the people who used them. The significance of the Jamestown ruins or of Columbus' settlement on San Domingo, for instance, would never be known, if indeed you were lucky enough to strike them.

You can therefore see how difficult it is to pick out a spot and say, "This is where the first Americans lived and these are the things they used." All we can really hope for is to determine what types of tools and weapons were used by the first large group to occupy the land, and from them to reconstruct their manner of living, their subsequent migrations and their relations to the people in other parts of the world.

You may ask why we searched in such a remote section. If you look at a map of South America you will notice that it tapers away to nothing. The only access to it, barring sea routes, is from the north. There is no exit. Once a people have traveled that far, there they must stop. It is literally the bottom of the bag, but whether the things we found have any relation to the first things thrown into it, only future work will show.

Twenty years ago a book was published in which all the information concerning the people of Tierra del Fuego and the adjacent territory from Magellan's time to the present was summarized and classified. In it the value of future archaeological work

there was stressed, but when I first saw it ten years ago in a little secondhand bookshop in lower New York, it was without the slightest thought that I would share in this work.

The first of January, 1933, however, found me alone on the trail over the mountains which lie between Lake Fagnano and the southern shore of

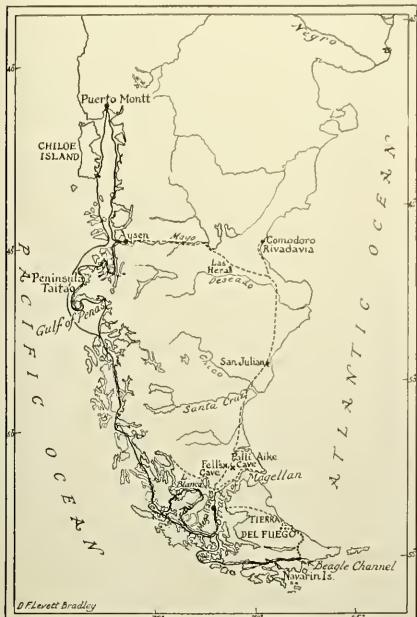
refutation of the popular conception of the Cape Horn region. The summers there will never make one as uncomfortable as in New York, nor will the winters be as cold. It is true that there may be a flurry of snow at what corresponds to mid August but it is not the rule. That the natives used to live the year around with little or no clothing is more a proof of the lack of extreme cold than of their hardiness.

The summer passed all too rapidly but before it was over I had combed through over ten thousand cubic feet of midden refuse, most of it from one of the best middens along the fifty miles of shoreline examined on the north side of Navarino Island. Archaeology loses some of its glamour when the task in hand consists of picking apart a Fuegian midden. The soft mussel shells have disintegrated into a moist mass; specimens are few and far between, a day's work yielding only from two to fifteen, counting every piece of worked bone or stone flake. There is a great deal of duplication, and when one sees the completed collection the first thought may be, "What an unattractive assortment of . . . trash." One wonders how any history can be reconstructed from them; but the story is plainly written.

First inhabitants

The first people to reach Navarino and the other islands about Cape Horn were simple folk; more so than the Yaghan Indians Magellan may have met, who are all but extinct today. Their manner of living and their food were almost identical with that of the Yaghans, but their equipment was even more limited. Having available the shell of a giant mussel which could be made into an unusually good knife in a few minutes, they never mastered the technique of pressure-flaking stones into knives or knife points. A few small scraping tools made from stone by percussion flaking, roughly sharpened chopping stones, whetstones, and bola weights, complete the list of the things they made from stone.

Through the centuries following the arrival of the first people there was little alteration in the type or pattern of the things used, then very abruptly we find a change. A new group of people have arrived. They introduce the bow and arrow, pressure-flaked points of stone for arrows, spears and knives, and other items. Even their houses are different: circular pits, 12 to 18 feet across by two to three feet deep, with one entrance instead of two. How to explain the survival of the earlier types of tools and weapons into this period is a matter for conjecture. Perhaps the two groups fused, or it may be that they occupied the region simultaneously. A number of



Route of archaeological explorations in southernmost South America. Solid line represents boat travel; dotted line, horse back; dashed line, car

Tierra del Fuego. At that latitude, tree line is at an elevation of about 1500 feet and not far above, there is snow the year round. It is not a difficult trail for one who knows it and is used to traveling with horses, but for a greenhorn to try to take three horses over was asking for trouble. That we got across without being bogged down speaks very well for the horses. The carcass of one horse lying beside the trail with only his head and back showing above the bog and the bleaching bones of others was a sufficient warning of what might happen.

The Beagle Channel country which opens out before one from the top of the pass is a delightful

reasons can be suggested, but it will be difficult to prove any one.

We have good evidence that it probably took between 1500 and 2000 or more years to build up the numerous and sometimes large mounds along Beagle Channel. How these figures are determined is a story by itself, but we must skip it for the present.

Exactly two years after I had my first glimpse of Beagle Channel, my wife and I were at Puerto Montt, Chile, a thousand miles to the north, preparing to launch our 19-foot cutter. We had purchased it there and after installing a small engine and fitting new sails and rigging, were about ready to start south along the coast—just the two of us. We hoped to pick up the trail of the ancestors of our Beagle Channel friends and to follow it down to that region.

Wind and rain

When you look at the map and see the maze of islands which lie along the coast between Puerto Montt and Cape Horn, it looks as if it might be the ideal place to go cruising. It is true that there are hundreds of miles of well-protected channels, that the scenery is superb, with mountains rising steeply from the sea to snow crowned summits as high as 12,000 feet with glaciers pouring down their slopes—but it has its drawbacks. The chief one of these is probably the weather. From the Guaitacas Islands down to the Straits of Magellan there is an annual rainfall of 120 inches or more. That would not be so bad if it did not come down in an almost steady, fine drizzle, blotting out the scenery and sun for days and weeks at a time. An Englishman once wrote that the weather of the western channels was "enough to make a man's soul die within him." There is no doubt that he was sincere in saying this for he committed suicide when faced with the prospect of having to spend a few more months there before starting home. But I do not want to give it a worse name than it has, and to prove that its influence is not always so bad I can only say that after five months of it my wife and I stepped ashore from the rather cramped quarters of the *Hesperus* still on good speaking terms.

Along with the excessive rain there is the usually more than excessive wind. It rushes in from an uninterrupted run of 6000 miles across the Pacific with an exuberant vigor that makes one think that it must love the land to be in such a hurry to get there. Later when we were working on the dry treeless pampa country east of the mountains we decided this wind must be "loco" as it dashes across the plains and off over the Atlantic with an impatience that shows that it has not found what it sought, un-

less it be the fine haze of dust it carries in its wake. Another slight drawback to a comfortable cruise is the open character of the coast about the Taitao peninsula and the Gulf of Penas. It is as though the sea challenged a boat to show her worth before allowing her to enter the smooth water of the channels south of the Gulf. The Indians used to portage their canoes and boats over the narrow isthmus of Ofqui and so avoid most of this, but that was impossible for us. Now an open windswept coast is nothing to balk at if one can stand well off and carry on past, but our job was to see as much of it as possible and to search the bays where our friends of the past would have been likely to seek shelter. There were times when we almost wished we had never started.

Two-thirds of this coast is uninhabited save for a few Indians of the Alacaluf tribe and an occasional lighthouse keeper. When we cleared from the little frontier settlement of Puerto Aysen (the last place we could secure gasoline and provisions), we carried sufficient fuel for 600 miles under power alone and four months' provisions, in addition to such incidentals as tools, clothing, cameras, and stove fuel. Anyone used to cruising in a small boat will realize what that meant.

Uncharted bays and inlets

The impossibility of securing more gasoline was a severe handicap. It is pleasant enough to run down a deep, narrow bay or fiord with the wind astern, but another story to beat back out of the same place. Many times we looked wistfully into winding bays and inlets not shown on the existing maps. Even when one knows that men have been there before you, there is an appeal about a place that is still a blank space on our maps which is hard to resist. That we did not always shut our eyes to temptation is indicated by the state of the tanks when we reached the first place in the south where they could be replenished. One was dry, the other held a fifteen minutes' supply, sufficient only to get us clear of a poor anchorage if it were necessary.

If the contents of the Beagle Channel mounds are discouraging, those along the western channels are even more so. The ground everywhere is saturated to such an extent that the first move must always be to dig a drainage ditch. This prevents the trench or pit from flooding, but does not check the constant flow which makes hip boots a necessity. The mussel shells here have gone beyond the crumbled stage and become a sticky paste. I can think of no better test for an archaeologist's enthusiasm than to have him work ten hours in the rain on one of those mounds. If he is willing to do it again, he merits his



THE *Hesperus*, the 19-foot boat in which Mr. and Mrs. Junius Bird explored 1300 miles of coast in southernmost South America as part of a three-year expedition for the American Museum. Remains of prehistoric man were their objective.

The tiny craft carried fuel for 600 miles under power, provisions for four months in addition to all their equipment, and was the Birds' home for five months.

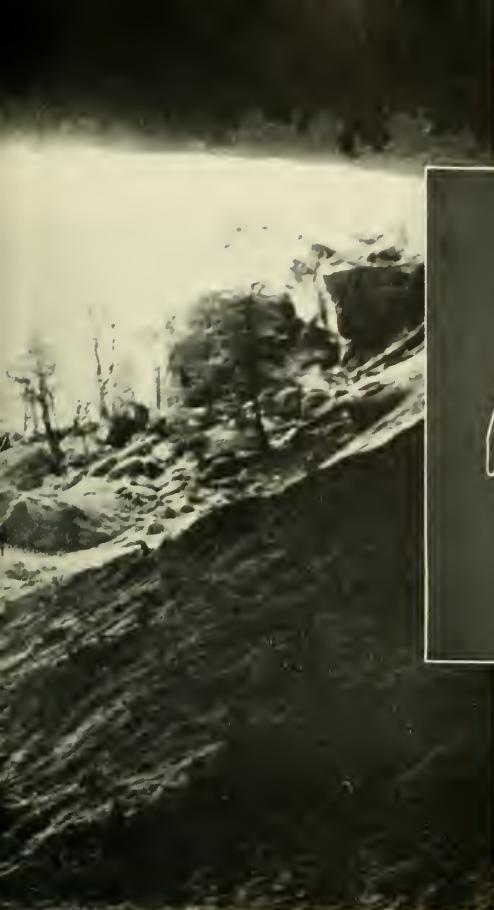
WITH CONTINUAL WIND AND RAIN to contend with along their subarctic route, the voyage was one of the most enterprising in the annals of archaeological exploration. At the end of the trip the couple arrived in the Straits of Magellan (at right) with only a 15-minute supply of fuel.

Scarpa Photo





Photo by
Thane
Bierwert,
AMNH



(Above) MYLODON CAVE, so-called after the extinct ground sloth which was once thought possibly to have been stabled here as a domestic animal by primitive man. Note the enormous size of the cave as shown by the human figure

(Left) GROUND SLOTH mother and child: a reconstruction of the gigantic animal which aroused world-wide interest 40 years ago when apparently fresh fragments of its skin, found here, started the myth that it might still be found roaming the unexplored mountain forests



(Above) THE PREHISTORIC GIANT GROUND SLOTH, whose remains, discovered by Mr. and Mrs. Bird, shed light on the life of early man in South America

This creature has the unique distinction of being the only prehistoric animal ever hunted for with firearms. At least one expedition was led in the hope of discovering it alive. Modern man has never seen it and never will, but primitive man was proved definitely to have hunted the animal at the dawn of recent times

(At Bottom) MYLODON CAVE, viewed from without. Even if sloths dispored themselves in great numbers in this gigantic cave there would be room to spare for it is 680 feet deep and 320 feet wide at the mouth

THE SKIN of the extinct ground sloth contains embedded pellets of bone, which doubtless served as a sort of armor. But in spite of this and contrary to beliefs that it might still be alive, the ground sloth became extinct before the coming of white man to South America. It is quite unlikely that the animal was ever domesticated, but it was hunted for food by the early natives

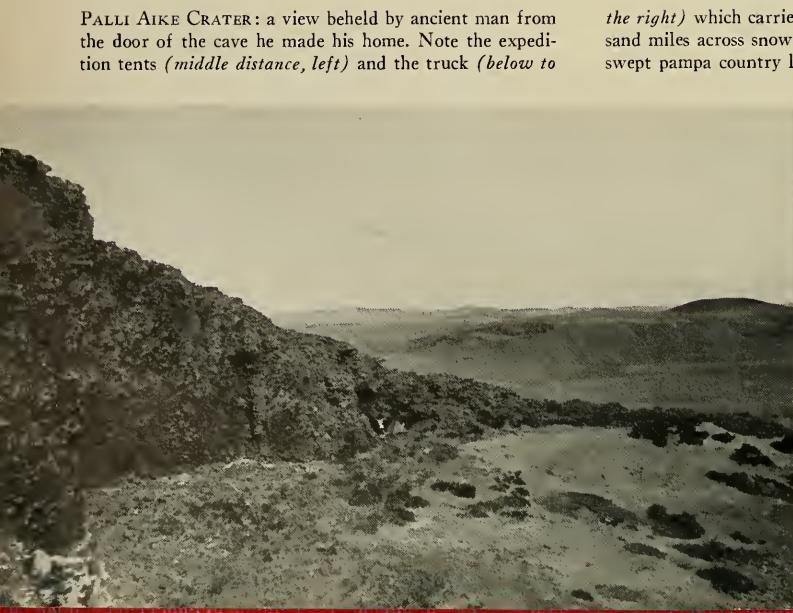




OXEN and a 20-year-old Model T Ford supplanted the Birds' boat for inland exploration. Here the expedition is shown within the ancient volcanic crater ridge in which



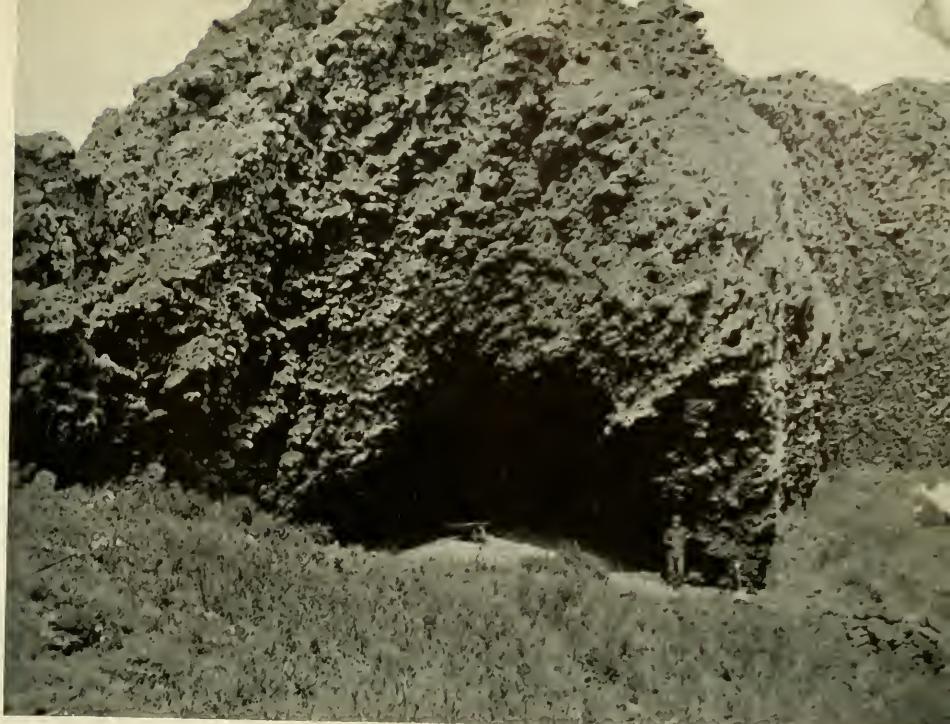
lies Palli Aike Cave, a site occupied by prehistoric man, from the time of volcanic activity



PALLI AIKE CRATER: a view beheld by ancient man from the door of the cave he made his home. Note the expedition tents (*middle distance, left*) and the truck (*below to*

the right) which carried Mr. and Mrs. Bird several thousand miles across snow-covered mountains and over wind-swept pampa country like that shown below





(*Above*) PALLI AIKE CAVE occupied anciently by some of the earliest people to live in this region. Giant prehistoric sloths also made it their exclusive home at one period. Prehistoric burials were dis-

covered in the cave, with fireplaces containing bones of sloths and an extinct type of horse, proving that man lived here prior to the disappearance of these animals



(*Above left*) THE FIRST TEST TRENCH in Palli Aike, illustrating the method of obtaining a complete cross-section of the refuse in order to estimate the value of extensive excavating



(*Above right*) Sifting material from the cave floor. Choking clouds of fine, dry dust made the use of masks imperative



(Above) FELL'S CAVE, showing the river 19 feet below where prehistoric man saw it

CONGLOMERATE CAPPED WITH LAVA

SILTY SANDSTONE

SHEEP MANURE

LAYER V

LAYER IV

LAYER III

LAYER II

STERILE DEBRIS FROM ROOF OF CAVE

LAYER I

BOTTOM OF EXCAVATION

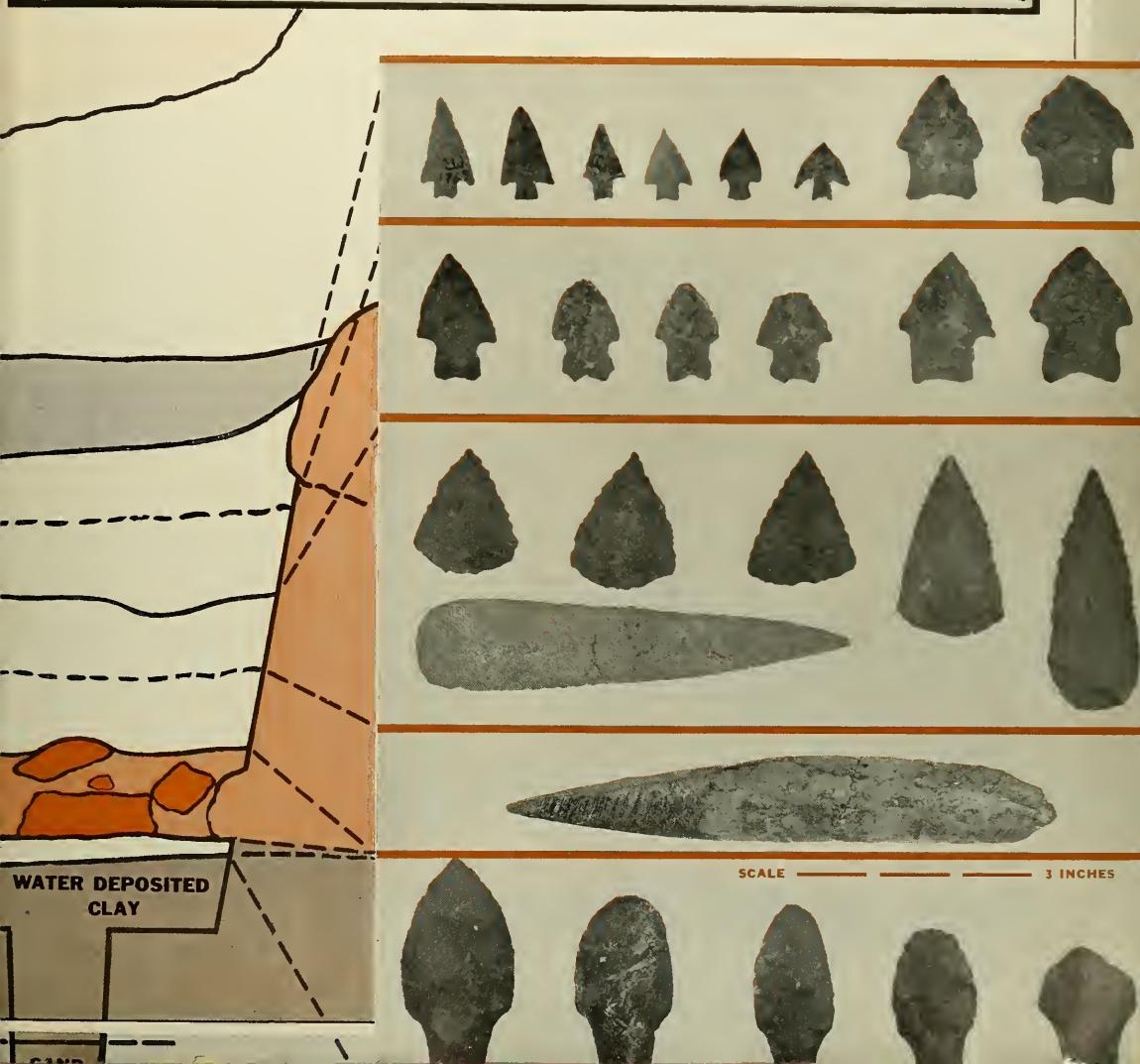
0 1 2 3 4 5 FEET



PREHISTORIC MAN'S "FARTHEST SOUTH"

The lowest row of arrow points illustrated below, excavated from Fell's Cave near the Straits of Magellan, were left by some of the earliest explorers known to have penetrated the southern-most continental land on earth. Dating from some time after the post-glacial movement of Asiatic peoples to the Americas, they represent one of the longest prehistoric migrations on record. Not long after the earliest people made this cave their home (Layer I), the ceiling collapsed, burying the remains of prehistoric horse and sloth and

the weapons of the people who hunted them. The second people to occupy the cave (Layer II) used spears tipped with bone and lived mainly on foxes and birds. The arrival of a third group (Layer III) is indicated by stone points and other distinctive weapons. These people were apparently driven out, to judge from evidences of warfare, by a fourth group using small, rough arrow points. The most recent group to occupy Fell's Cave were Ona Indians of about the time of Magellan (Layer V)





(Above) REMAINS OF PREHISTORIC SLOTH and horse uncovered in Fell's Cave. At bottom, the shoulder blade of a modern horse has been introduced to show comparison with that of the prehistoric horse just above it



THE EXTINCT HORSE known to the early inhabitants of South America was a smaller, stockier animal than the modern Patagonian horse, as shown by a comparison of their jaw-bones above



SCATTERED GROUPS of Alacaluf Indians like those above were the only native inhabitants along most of the lonely coast cruised by the *Hesperus*



(Above) PRIMITIVE WATTLE HUTS in which the Alacaluf Indians find shelter from the raw climate. Overlapping seal skins prevent the almost constant drizzle from entering

DESCRIBED AS MURDERERS and thieves of the blackest sort, the Alacaluf proved to be an indolent people possessing clear ideas of right and wrong, though somewhat different from ours

COARSE, MATTED HAIR, sullen expressions, and legs dwarfed by the constant use of canoes, belie their quite human characters. Life makes few demands and offers little

THE ALACALUFES acknowledge no chiefs; hence there are no laws or taxes. It rains all the time, so why not sit by the fire?



(Below) REMNANTS of a tribe almost extinct: two Yaghan boats leaving Puerto Pescado, Navarin Island. In the background is the site of an ancient camp excavated by the author



(Below) THE *Hesperus* coming ashore for overhauling; no beauty, she proved a remarkably good boat in rough weather. Even with the mattresses on the floor of the cuddy there was barely room to sit up



BEFORE MAGELLAN

(Left) OUT OF GAS but with the wind astern the truck is sailed on to the next supply

title. Four specimens represent the average day's collecting, and I have spent a full day in one large midden without finding anything.

When we compare the things found with those from further south, there is no doubt of the connection between the two regions. The most striking difference is the lack of stone tools and weapons. In the older middens of the western channels we find stones used only for sharpening the shell knives and for crude chopping tools or hand axes. At a relatively late date pressure flaking was introduced along with the bow and arrow, but it is not the work of the southern house-pit people.

Disturbing tales

We had been warned repeatedly against the Indians living between the Gulf of Penas and the Straits of Magellan. They were reputed to be murderers and thieves of the blackest sort; if they did not kill us outright they would at least take our boat and leave us stranded. Part of these tales we attributed to an understandable human desire to put us in the right frame of mind, part to a misunderstanding of the natives' real nature, as the stories improved in direct proportion to the informant's lack of experience. The earliest contacts with whites had been friendly enough but for many generations there have been incidents not calculated to inspire confidence on either side. Natives are living who in the course of their lives have been shot at, and all have probably received the poor end of a bargain when trading skins. Under the circumstances one cannot expect to be greeted as a long lost friend; and when we saw the smoke from one of their camps and crossed over to an island to meet them for the first time, there was a moment when we were almost willing to believe what we had heard.

No one will deny that their looks are against them. Coarse, matted hair, sullen expressions which take but little imagination to construe into looks of hate, and legs dwarfed in comparison with their well formed chests and arms as a result of lives spent entirely in canoes and huts—all these contribute to a poor impression. But face to face with reality ones mental picture fades, the demons become men and women possessed of normal human characters. They have clear ideas of right and wrong, though different perhaps from ours; they may be lazy and indolent but these qualities are not unknown elsewhere. Life makes few demands; there is an abundance of shellfish for food; fuel and drinking water are everywhere, a canoe need be replaced only once every few years, a house can be constructed in a few minutes; they acknowledge no man as chief, hence there are no laws, no taxes, nothing to

live for except life itself. It rains all the time, so why not sit by the fire? Having lived with them I do not envy their simple life, no one could; but once they are extinct they will have their champions. Contrary evidence being then lacking, they will doubtless be idealized as creatures to be envied, their life a golden *Odyssey*.

On our arrival at Magallanes, formerly Punta Arenas, at the completion of the western channel trip, winter was well underway. We had hoped to find some large midden along the Straits where a permanent winter camp could be established, but there are none, on the north shore at least. With no alternative we went further south to Ponsonby Sound where we had heard of a large rock shelter. This proved an ideal location for winter work, a high cliff protecting and overhanging a large shell mound. With the completion of the excavation there we moved to another shelter I had seen previously on Beagle Channel and later to a third in Yendagaia Bay on the south side of Tierra del Fuego. The results in each case confirmed and added to the information recorded in 1933.

Exploring with a Model T

With the coming of spring we returned to Magallanes, bought a twenty-year-old Model T Ford truck and followed the northern shore of the Straits eastward with good success in locating camping places of the Foot Indians. These people lived principally by hunting land animals and differed greatly in physique and culture from the Canoe Indians of the western and southern channels. The "giants," first reported by Magellan, were of this group. It is certain that there were some very tall men among them and that their average was above normal, but the figures given by several authors of between 9 and 12 feet are best explained as travelers' tales, told, as Sir Francis Drake's chronicler puts it, because "they did not think that ever any man would come thither to reprove them, and thereupon might presume the more boldly to lie."

All of this country along the eastern part of the Straits and north into the Argentine is open grassland, good for sheep raising but settled only in the past 50 years. With only a fraction of the rainfall of the forested western coast it is hard to believe that the two regions are so near to each other. Its one unpleasant feature, the strong westerly wind, has worked to our advantage. Because of it the Indians made their camps, when possible, in sheltered places, resulting in a concentration of their broken, discarded or lost belongings where they can more easily be located.

Continued on page 77

HERBS AND SIMPLES—JUNGLE STYLE—*You never know how much of the effect is mental, but in case of accident you may be glad you are on the good side of the witch-doctor*

By RICHARD C. GILL

WHAT do I think of jungle medicine? Well . . .

Even now, after several years have passed, I can still close my eyes and see the curling, bobbed hair of the Niña, my wife, flying wildly as she fell, turning over and over for twenty-five feet through the air, only to land in a crumpled heap on the hard, sun-baked floor of the jungle clearing and remain quite motionless. Whole decades passed dully while I somehow scrambled down and stumbled, panting, to her side.

The jungle's edge

We had been standing on top of the embankment, watching our gang of peon-sawyers below us rough-hewing *canelos* logs for sleepers in the uncompleted portion of our ranch house in Ecuador. For several months, we had been exploring to find a suitable site on the eastern slopes of the Andes for our ranch, where I could carry on my ethnological observations as well as try my hand at being a modern pioneer; and we had finally located in the Pastaza Valley, on the edge of Indian country.* The timbers which we were watching emerge from the hand-felled jungle giants were to become, eventually, a modernly equipped, seventeen-room house, several hours by horse-trail from the bitter end of the last tortuous automobile road which wound Amazon-wards from the high Andes.

Almost as soon as I reached her side, the Niña opened her eyes and, failing to utter the conventional groan, tried to get on her feet. The first step, however, showed the folly of that, so the frightened sawyers and myself carried her to the ranch house a mile away.

Her injuries, while not too serious, were painful and incapacitating. The egg-size lump on the head could easily be reduced, and most of the long splinters (we counted over sixty of them) could be

*See "How to be a Medieval Baron," by Richard C. Gill, in *NATURAL HISTORY*, March, 1937.

tackled successfully by first aid, though a few of them were deeply imbedded and I was appalled by the series of minor operations necessary to remove them.

But the badly wrenched knee, with the slipped ligament, left me helpless. I knew that such a thing could be worse than a fracture, and that all I could do would be to lessen the pain and have a horse-litter constructed for the long and painful journey "outside" to the nearest medical aid.

I had no sooner mentioned the idea to the Niña, who managed a grimace at the thought, than someone knocked at the bedroom door. It was old Lopez, the head-sawyer, a *cholo* (half breed), bent and gnarled by fifty and more years of work in the deep jungle.

"*Aie, Señor, mi patrón,*" he said, and the sun-wrinkles around his dark eyes furrowed with sympathy, "the poor *Señora, la pobre Ninita*, she is badly hurt, no?"

"Medicine"

I nodded my head distractedly and recited the list of injuries. His Indian mouth suddenly smiled, like a wide gash in seamy, weathered leather.

"And nothing more than that, *Señor?*" he asked. "Look you, *patrón*, I have not spent fifty years in *Las Amazonas* for nothing. I have learned many things from the Indians . . . from the Napos, the Zaparos, the Arajunas, all the great Runiaru people, and even . . ." he bent closer to me ". . . and even, *mi patrón*, from the Jivaros. And you, yourself, know that their *brujos*, their巫men, are the best in all the jungle . . . even though they do snick off an occasional head or so."

I nodded. I already knew the profound respect in which the medicine-magic of the *brujos* was held by the jungle-wise.

Within a few moments, old Lopez had me half convinced. And, then, I wanted to save the Niña the wrenching torture of the litter on a rough trail. I told the ancient jungle elf to go ahead, and his scarred, bronze face seemed to crack in two with a

jagged grin as he scuttled off to gather what he needed for the treatment.

He returned in less than ten minutes, followed by the waddling, fat-jowled and equally ancient (and I suppose equally jungle-wise) peon cook, who was his especial crony. The old man had with him two or three dirty cloth bags of various herbs, a tin plate, a bundle of fresh, thick, green leaves of some sort, and a small amount of kindling. The cook came in apparently empty handed, but, as soon as she had clucked sympathetically in Napo-Quechua at the Niña, and seated herself on the floor beside the bed, she drew forth from the hidden recesses of her ample costume the following surgical equipment: A dull and worn kitchen knife, a roll of homespun cotton bandage, a cup of guinea pig tallow and two live guinea pigs which were in a thoroughly remonstrative mood.

Smiling happily, the *cafe au lait* gnome turned to me. "The *clínica*, the hospital," he announced, "is complete, *patroncito*."

I looked at the Niña with that questioning look which can be interpreted only by an experienced Other Half. "I—I think it might be fun," she said. "And if it doesn't help any, we can always go outside tomorrow. And . . . and anyhow it's something for the notebook, no?"

Lopez and the cook went ahead.

Shades of Lister!

First of all, after a hurriedly whispered consultation in Quechua, the old man opened one of his bags of herbs and added some powdered leaves to the guinea pig tallow, which the cook kneaded thoroughly. I offered a prayer to the shades of Lister and Pasteur when the mixture was applied to the sites of the deeply imbedded splinters and covered with the homespun bandage. They told me it was the world's best poultice. It proved to be. Without the slightest sign of infection, the splinters had worked out in twenty-four hours.

Then came the wrenched knee with the slipped ligament. The two unkempt black-and-copper heads bent together over the swollen joint, while gnarled, brown fingers explored it with a light deftness which amazed me. A few mumbled words, and Lopez and his aide waded in.

Placing the tin-plate on a block of wood in the middle of the bedroom floor, he built a small fire on it with the kindling. In the meantime, the cook had greased the knee with more of the tallow. Then, as soon as the fire was well lit, Lopez lightly massaged the knee with a series of painless manipulations which I had never seen before.

Afterwards, as soon as the flames of the sawyer's small fire had died down, he threw a handful of herbs from another one of his bags on top of the hot embers; then he rapidly overlaid them with the green leaves he had brought in with him. Within a moment or so, they were heated through and giving off a pungent, aromatic vapor. He sniffed the grey, curling smoke and called softly to the cook who came over and squatted down beside the fire with him.

Looking into each other's eyes, they mumbled a low-voiced incantation in the rapid Napo dialect, which Lopez later refused to explain further than that it was "*un rezó de la selva . . .* a jungle prayer, Señor, and you can't expect a jungle-cure to work without *that*." Meanwhile I had to content myself with merely hoping for the best, leaving the invocations as well as the medical technique to the two bowed figures on the floor.

When the leaves were ready, the two lifted them hot from the fire, rubbed them with more of the tallow, sprinkled them liberally with flaming red *achiote* (paprika), and applied them steaming to the Niña's knee. Then they wrapped it with more of the homespun cloth.

The cook, after gathering up the two live guinea pigs, left without a word, but Lopez stayed behind for a few minutes. Bending over the Niña, and lightly touching her head, he spoke rapidly to her in his own brand of obsolescent Spanish, "Remain here in bed, Señora . . . and sleep, sleep, sleep. You will sleep until the morning; then we shall again treat the knee. In ten days you will be well and riding *La Coqueta*, your mare. The *selva*, the jungle itself promises it. And that is better than a month in the hospital, no? Now, Niña . . . sleep . . . sleep . . ." She slept for hours.

A considerate practitioner

Outside the bedroom door, I asked Lopez why he had not used the two live pigs. "Because the Niña would be very *delicada* in such a matter," he told me. I nodded affirmatively. I already knew how the little animals were used in such cases. They are rubbed until they are suffocated against the injured part to "absorb the hurt." Then, when the thing is done in real Indian style, one has its throat cut, as a *brujo* sacrifice, over the fire used to heat the medicaments; the other is split open, eviscerated, and applied "as is" as a ready-made poultice. I agreed with Lopez. In such a matter, the Niña might be *delicada* . . .

The jungle-elf was wrong in only one thing. The Niña was walking normally and riding a horse within a week, not ten days.

A medical man might reasonably doubt that the treatment assists specifically in the patient's recovery, but be that as it may, you will understand how I was prompted to investigate the Indians' *Materia Medica* along with some other phases of primitive culture. And when my inquiry led me into a glimpse of their everyday, matter-of-course, so-called magic and enabled me to jot down some of their as yet unpublished folk-lore, I felt repaid for the months of arduous prying into the secrets of the jungle's most exclusive caste . . . the modern witchmen.

It is the most fascinating and most inexplicable aspect of Indian life I have seen. While the drugs, themselves, are usually simple enough, and much of the physical therapy employed is sound, the whole technique of treatment is overlain with such a veneer of primitive "magic" and ritual that it is sometimes impossible to distinguish the line of demarcation between the effects of physical and psychic reaction.

Auto-suggestion in the patient, stimulated by the witchmen, certainly shares full honors with the potent jungle pharmacopoeia. At times, it uncannily enough seems to accomplish its purposes, either for good or evil, without any tangible aid. Or is it that after one has observed the efficacy of primitive medical practice for a while, his modern, sheerly mechanistic point of view sometimes slips a cog when he suddenly finds himself face to face with phenomena that cannot altogether be explained on a purely physical basis?

Witchman's pharmacopoeia

During the course of my previous observations of South American Indian culture, I had already taken a deep interest in what is still to me the most striking example of jungle pharmaceutical manufacture . . . Curari, the flying-death.* Curari is the still-mysterious, extremely lethal arrow-poison employed mainly by the blow-gun users living east of the northwestern Andes. Although manufactured in the most primitive way and by means of superstitious ritual, modern science has nonetheless been unable to find a wholly successful antidote for its death-dealing qualities. And Curari is only one of a score of potent drugs listed in the pharmacopoeia of the *brujos*, the *yumbos*, the *cucucuna* . . . the witchmen who haunt the vast tangled greenness of the Amazon Valley. Here is a brief listing of some others†:

BARBASCO: This substance, used in the form of an infusion, is made from the leaves, tendrils,

*See "Curari, The Flying Death," by Richard C. Gill, *NATURAL HISTORY*, November, 1935.

†These notes are based on the healing methods of more than one tribe in the Ecuadorian Oriente and, owing to the brevity of the article, I have made no attempt to differentiate either the customs or the drugs I have listed on a regional or tribal basis.

and roots of the so-called Barbasco plant. It is employed primitively as a fish-poison. When introduced into a stream in liberal quantities (particularly into a more or less quiet pool) it stuns the fish, making them float on the surface. Then they are easily gathered up by the eager Indians who consider a Barbasco fishing party an uproarious festive occasion. This drug is also finding its place in modern science. It is used as an insecticide and, oddly enough, has occasionally been used to remove barnacles from the hulls of ships. The Barbasco imports into this country, however, are necessarily limited since the majority of it still has to be got laboriously from the jungle by primitive means.

GUAYUSA: A tea-like preparation made by steeping the leaves of the plant of the same name in boiling water. It is widely used in the Ecuadorian Oriente specifically as an anti-rheumatic and generally as a restorative. In fact, on the arduous overland route between the Pastasa and Napo Rivers there is an overnight station called *Guayusa Loma* (hill) which is always welcomed as a night's camp by the Indian porters; the plant grows so abundantly there that they can be sure of being able to brew themselves plenty of the mildly stimulating drink. There is also a firm regional belief that *guayusa* increases fertility in women.

AVELINA ROSADA: A pinkish jungle root which, when peeled and crushed with water, is universally used by the Indian women as a hair shampoo. If its effectiveness can be judged by the results obtained, the thick and lustrous ebony tresses of the jungle women who use it should be a good advertisement indeed. The scattered whites living in that sparsely settled region employ it frequently to remove dandruff (which seems to be rare among the Indians) and as a general "restorer".

Most sought after

AVELINA BLANCA: A whitish root similar in appearance, save in color, to the Avelina Rosada. From a sheerly commercial point of view, this is one of the most fascinating of all the jungle drugs. Placed in the civilized cosmetic market in sufficiently large quantities, its money-value would be hard to estimate. The Indians claim that it is the most sought after of all cosmetic preparations . . . a permanent, harmless depilatory. The root is widely used by the different Indians from the Napo River, in a southerly direction, down into the Bobonazo-Pastasa region. With it the Indians remove all superfluous hair from their bodies, and the results seem lasting after only one or two applications. The skin, where the depilatory has been applied, looks soft

and smooth, as if it had never supported a growth of hair.

GUAYAHUASHCO: An herb decoction used among certain of the Oriente Indians as a narcotic and soporific. It is not only employed as a medicine but as a ritualistic drug among the Jivaros where it is administered to induce a state of coma in the witchmen and the elder warriors. While under the drug's influence, the future—usually of anticipated battles—is prognosticated for them in the form of visions and hallucinations.

UNGURAHUA: A vegetable "hair oil" extracted by the women and used as a hair dressing after the hair has been washed with the Avelina Rosada.

JIVIJIVARA: Another decoction beverage used as a rule as an anti-rheumatic and general anodyne for muscular and articular aches and pains.

TOBACCO: Aside from its normal use, tobacco is widely employed among the Napos as a stomachic and carminative.

COPABANGA-MEMBRILLO: Each word is the name of a separate leaf (both from trees) which when mixed together and partially stewed form a dressing for wounds and tropical ulcers. The membrillo leaf, employed by itself, acts as a mild caustic.

COPA MARIA: (The word "copa" is often used by the Quechuas to designate "leaf".) A leaf which when sundried and powdered is used as an astringent for wounds, and seems to possess unusual healing qualities.

COPAIBA: Another Indian drug which has found its way from the jungle to modern medical science where it is used as an astringent for mucous surfaces.

ACHIOTE: (the paprika of commerce). This is widely used not only as a face-paint and lip-rouge among the Indians but also as a poultice and counter-irritant for both humans and animals.

"Bottled sunshine"

Another interesting medicament, found not only in the Oriente region but also among certain coastal aborigines, is a high-vitamin oil rendered from the bodies of grubs found in the roots and trunks of several species of palm trees. Certainly this would seem to be based on the most modern therapeutic standards! After a crude process of refinement this "bottled sunlight" of the jungle as effectively builds the patient's resistance against pulmonary infection as do our own carefully prepared high-vitamin fish-oils.

In addition to the drugs and remedies already listed, the huge natural storehouse of the Amazon Valley provides its bronze-skinned children with

scores of other remedies and medicines. Some of them are known to us and, I suspect, just as many are yet to be discovered by civilization.

Cocaine (derived from the coca plant) and quinine are, of course, two of the best known drugs originating in South America. There are also, among the lesser known medicaments, toothache remedies, bodily unguents, skin-hardeners, natural sun-tan oils, and several different ointments and skin-dyes used for protection against flies and other insects. A lush and vital nature also provides the Indians with medicines supposed to be efficacious against snake bite and against fever, at least one vermifuge (a helminthic), several species of moss used for dressing wounds, and—on the darker side of things—various interesting poisons and aphrodisiacs.

So, all in all, the jungle gives to the jungle-wise quite a well-stocked drug store. Every article in it carries the same price tag:—the skill and knowledge necessary to pick it down from Nature's shelves. At the very least, the pharmacopoeia of the Amazon is able, adequately, to take care of all the ordinary ills and accidents which occur among the native jungle dwellers.

The bedside manner

But, even more interesting than the actual drugs are the methods of administration and the actual "sick-room technique" . . . the last being almost always in the hands of the witchmen and the tribal grandmothers. Their whole system of therapeutics is inextricably mixed with their folk-lore and with their witch-craft.

After all, it wasn't so long ago that our own medicine was deeply bound up with superstition and folk-lore. Indeed, it is only with the rise of very modern science that the medical art has loosened itself from that famed triad, Mystery, Magic, and Medicine. Our jungle friends, however, still employ that curiously effective combination which, when it is reduced to its simplest elements, is nothing more than a copious admixture of auto-suggestion with actual drugs. And that would seem to be sound medical practice.

In the Ecuadorian Oriente the *brujos* (the witchmen) and the *jatun-mamacuna* (the grandmothers) are the healers, the gatherers and the dispensers of the pharmaceuticals, as well as the storehouses of the folk-lore, legends, and rituals with which so many of their therapies are tangled. In this particular region, the witchmen are greatly respected and feared . . . both for their actual and nuisance value. Indeed, their sphere of influence is so great that formidable difficulties and obstacles are set before the explorer who would investigate the *materia*

medica of the jungle. And the cackling, white-haired grandmothers are, after all, pretty jungle-wise old dowagers. In their unlovely heads reposes the lore of the ancient days. In some regions where the Inca civilization swept down from the highlands into the jungle, one finds traces of it still current in the spoken lore. In addition, the old women are the nurses and the first-aiders . . . and the mothers of the witchmen.

But the witchmen (the *brujos*) are the real doctors who parcel out magic and medicine alike from the murky depths of their ancient and still mysterious cult. Indeed, apart from their medical activities they are curiously potent figures, these jungle magic-men. All too frequently they deal in death as well as in life. In fact, the jungle Quechua word for medicine is the same as that used for poison . . . *jambi*.

The making of the arrow poison, Curari, is an example. The naked witch-doctor squatting low beside the boiling decoction of dark brown poison will also at the same time attend to the making of curative remedies from the ample stock of life-giving herbs ranged beside more lethal species.

But, at that, the witchman dealing in life and death is, from one point of view, not too far removed from his civilized colleagues in our own modern laboratories who divide their attentions between life-giving drugs and serums for the benefit of humanity and the making of high explosives and poisonous gases for the dubious benefit of the next war.

The psychological effect

On the darker side of their cult, the Amazonian *brujos* are past masters in the useful, if sometimes deadly, art of auto-suggestion . . . that uncanny form of psychic control which we moderns are just coming to employ as a therapeutic agent. Since the days of Doctor Mesmer, and since the coming into good repute of some of the more intangible aspects of psychiatry, we moderns are being relieved of many of our psychic ills by this means. Here the jungle men have long anticipated us because, along with the administration of their own tangible medicines, they use a complicated ritual of exorcism which is nothing more or less than helpful auto-suggestion.

Potently helpful as jungle auto-suggestion is, however, it also has its seamier side, which we might well think of as being a sort of witch-doctor malpractice. Not infrequently Indians are "bewitched" and made ill or otherwise incapacitated, and it is sometimes said that death may even be caused by auto-suggestion.

Where malicious psychic influence occurs among primitive people it is quite often referred to as the "evil eye" but in the Napo region it is known as the "death-finger". Young children and domestic animals in the Ecuadorian Oriente, as in other regions, are protected from it by means of a red ribbon or string tied around the neck.

Strong "medicine"

In one instance, I was able to be an indirect witness to a death which to all appearances was caused by primitive auto-suggestion. It occurred at a missionary post a short distance away from the town of Tena, on the river Napo.

A *brujo*, or witchman, was incensed by the influence of the missionaries over the neighboring natives. He chose as the martyr who should serve his cause the about-to-be-married daughter of a local Christianized chief, or Curaca, and publicly announced that she would die at a certain hour. Despite the best efforts of a medical missionary and of her own kinsmen she died of indefinable symptoms at exactly the time specified. The witchman had meanwhile escaped down the river.

To add to its primitive potency, the auto-suggestive power of the witchman is greatly strengthened by a belief in his ability to transform himself into an animal. In this part of South America, tradition and legend give the witchmen the power to take the form of a jaguar, at will, with the coming of night. The Indian layman believes that this feline *alter ego* of the *brujo* can mysteriously attack and devour him once the death-finger has been pointed at him. There have even been instances of finding the victim's body severely lacerated, as if by the claws of a jaguar, at the ordered time of his death.

Behind the jungle practice of medicine and witchcraft in both its good and bad aspects, lies that vast store of Amazonian folk-lore and legend which for countless generations has been handed down by word of mouth by the tribal oldsters around the clan fires at night. Delightful legends with disciplinary motifs are told the children; and the elders enjoy the darker tales of the olden days. This semi-religious lore contains a whole Amazonian Olympiad . . . a still unassorted and unpublished hierarchy of jungle gods and goddesses, good and evil spirits, and strange semi-mortals. There is even a version of the universal flood legend in which nearly the whole world (the Napo Indian world, of course) perished.

These legends superimposed upon their materia medica and their good and evil magics, furnish the *brujos* not only with their drug and treatment lore but also with their professional ethics. Every wound

Continued on page 76

PITCAIRNIANA—*A commentary on the mutiny of the Bounty and its sequel on Pitcairn Island*

By H. L. SHAPIRO

*Associate Curator of Physical Anthropology,
American Museum of Natural History*

WITH a long narrative poem, two movies, a half dozen novels, scores of books and countless magazine and newspaper articles to its credit, the story of the Mutiny of the *Bounty* has apparently been thoroughly exploited. But despite this flood of literature, the interest in the *Bounty* remains inexhaustible for a considerable body of enthusiasts. The flushing of any scrap of new evidence concerning the circumstances or the personalities involved in this romantic tale of the seas is enough to bring these *aficionados* to instant attention.

But both the passing interest of the public and the enduring enthusiasm of the Pitcairnist have been mainly focused on the event leading up to the mutiny and on the subsequent violence on Pitcairn.

The history of the descendants of the mutineers has received relatively little notice. There is, of course, good reason for this concentration on the drama of the *Bounty* saga. Even unadorned by literary skill, its epic qualities are apparent in the bare narrative itself. The story falls into three quite distinct acts, each crowded with exotic color, movement, passion and tragedy. In the first occurs the long voyage to Tahiti, the building up of a motivation for the mutiny, the idyllic interlude at Tahiti before the disaster, and finally the destruction of a maritime microcosm by mutiny.

The second act opens with the woe of a boat-load of sailors cast adrift by the mutineers in a vast, uncharted sea. Scenes which move with the slow, tense rhythm of a Greek tragedy depict the horror and suffering of men struggling with nature, and create an unforgettable impression of human courage born of despair and indomitable will.

Finally, in the third act comes the resolution of the preceding events. Here the mutinous actors, taking with them Tahitian women, flee from their crime only to destroy each other on a remote island.

Although these three acts in themselves form a perfect whole, nevertheless a sequel took place to provide the happy ending which the contemporary Victorians demanded in their dramas. Indeed, to our 19th century predecessors much of the moral significance of Pitcairn rested on this subsequent phase of its history. The redemption of the descendants of the mutineers provided an extremely apt parable for the pulpit and the Sunday School. Thousands of tracts were once circulated in England and America in order to drive home in young minds the moral illustrated by the Pitcairn Islanders, who, it was said, lived in a harmony and a beauty most favorably contrasted with the depravity and sin of their mutinous fathers. This transformation was achieved by the religious precepts which John Adams, the sole survivor of the *Bounty*, taught to the numerous flock of half-caste children, left by the mutineers.

It is easy to see that a narrative embracing such a range of events and emotions might fully suffice to occupy the imagination without further material. And yet to inquire of the fate of the hybrid colony, to seek to know what has happened in this unique mingling of culture and blood, is a natural curiosity. It was my good fortune to enjoy the opportunity to pursue some investigations along these lines, but before describing some of these lesser known aspects of the Pitcairn Islanders let me sketch briefly the circumstances that created on Pitcairn a natural experiment in culture contact and in human genetics.

HARRY L. SHAPIRO, a frequent contributor to the pages of NATURAL HISTORY, made his first attempt to go to Pitcairn Island in 1923, but without success. Not until eleven years later and after sev-

eral efforts did he finally succeed in reaching Pitcairn, as a member of The Templeton Crocker Expedition to the South Pacific. He has made five trips to the Pacific, besides expeditions to

the West Indies, the Southwest, Canada and the Orient. He is the author of several scientific articles and of the book, "The Heritage of the Bounty."

—THE EDITOR.

On December 23rd, 1787, *H.M.S. Bounty*, under the command of Lieutenant William Bligh, was dispatched to Tahiti at the behest of a group of West Indian planters. The purpose of the expedition was to secure healthy cuttings of the bread-fruit tree which might then be transplanted in the West Indian colonies to serve as a perennial and cheap source of food for plantation slaves. Ten months later, in October 1788, the *Bounty* arrived at Tahiti where she was welcomed by the natives with kindly, if not warmer, feelings. During the course of the next six months Bligh packed the hold of his ship solidly with over 1000 bread-fruit plants. And finally, in April 1789, he was at last ready to return home. Some three weeks after the departure from Tahiti, when the *Bounty* was passing through the Tonga group, the now notorious mutiny occurred under the leadership of the Master's Mate, Fletcher Christian. Bligh and 18 loyal members of the crew were set adrift in a small open boat, meagerly provisioned. For 41 days through incredible hardships, Bligh guided his frail craft over 3618 miles of unknown seas, finally arriving at Timor in the Dutch East Indies. Meanwhile, the mutineers under the command of Fletcher Christian took charge of the *Bounty* and retraced her course to Tahiti.

Circumstances of the mutiny

The interest which the public has always exhibited in this maritime event may be measured by the vehemence of the controversies which have raged around the circumstances of the mutiny. It would take us too far from our purpose to dwell on this aspect of the *Bounty's* history. It is perhaps enough to say that the responsibility for the mutiny can never be entirely resolved, since the issues involve questions of human behavior and moral judgments. Certainly Bligh was in part to blame for his brutal behavior both to the crew and to at least one of his officers, Fletcher Christian. Apologists of Bligh, however, refer to the wide disciplinary latitude allowed to shipmasters in the 18th century. Detractors, on the contrary, point to Bligh's record which contains another mutiny famous in the annals of New South Wales. Other elements which help to explain, if not to place the blame, of the mutiny appear in the personality of Christian which, according to his contemporaries, was unusually sensitive and quick to emotion. Moreover, the crew itself was more than ready to return to Tahiti. The sailors, being on the average only 26 years old, were undoubtedly more susceptible to the immediate allure of aphrodisiac Tahiti than to the distant threat of future punishment in England.

Whatever may have been the cause of the mutiny, the consequences, at least, are better known. The mutinous party at first attempted to set up a colony on the island of Tubuai, near Tahiti. The quarrels which arose with the natives and among themselves soon forced the mutineers to return to Tahiti where they split into two groups. One, consisting of 16 men, preferred to remain at Tahiti; the other, of 9, fearing reprisals by the British government, was eager to seek a safe retreat. The nine mutineers, including Christian, finally determined to part from their companions. They took the *Bounty*, 12 native women for wives, and 6 native men as servants, and in September 1789 sailed away into an unknown world. When the *Pandora* arrived at Tahiti several years later on a punitive expedition, no trace of the nine mutineers or of their native followers could be discovered. The quest was finally abandoned, and the British Admiralty had to content itself with bringing to trial and to punishment the survivors of those mutineers who had tarried at Tahiti.

The mutineers' colony discovered

Then, in 1808, 18 years after the disappearance of Christian and his party, Captain Mayhew Folger of the *Topaze*, sailing from Boston, put into Pitcairn Island for water. This tiny island was charted as uninhabited, but to his astonishment Folger was greeted by a canoe-load of spry, handsome youths who addressed him in English. They were, he discovered, the sons of the lost mutineers and of their native wives. He met and spoke to John Adams, the sole, male survivor of the original party, and from him heard a shocking story of cruelty, tyranny and blood-shed. Adams informed Folger that on the arrival of the *Bounty* at Pitcairn she was burnt to the water line and run onto the rocks in order to prevent desertion from the new-born settlement. Soon after their arrival, one of the mutineers demanded another wife when his own lost her life by falling off a cliff. Since none of the Englishmen was inclined to give up his marital rights, one of the native men was deprived of his wife in order to satisfy this demand. This together with other acts of oppression embittered the native men and aroused them to revolt against the treatment of their English masters. Although the details of the ensuing events are confused by several varying versions, they all agree that the six native men and all but two of the mutineers died by violence. When Edward Young succumbed in 1800, he was the first male to die from natural causes. Thus, ten years after the landing at Pitcairn, John Adams found himself the sole protector of a colony of ten native women

PITCAIRN ISLAND

IN 1790, nine of the mutineers of the *Bounty*, together with their Polynesian followers, landed on Pitcairn Island where they established a colony unique in maritime history. The extreme isolation of the island insulated this tiny community from contact with the world for 18 years after its settlement. The beetling cliffs and the

encircling rocks made landing so difficult that the islanders were secure against the maraudings of the hordes of whalers who infested these waters in the mid-nineteenth century. In extent Pitcairn is 2 miles long by 1 mile wide. The nearest inhabited island is over 300 miles distant

PITCAIRN'S SILHOUETTE is
like an up-turned canoe



THE FIRST CONCERN of the mutineers, after landing on Pitcairn, was to build shelter. They chose a site now known as Adamstown, named in honor of John Adams, one of the mutineers. The village now contains over 50 houses, and their shining metal roofs glisten through the heavy foliage which surrounds them. The old village green laid out by the mutineers has now disappeared under a tangle of vegetation

The accompanying photographs of Pitcairn Island are reproduced through the courtesy of Templeton Cracker and James Chapin

THIS IS BOUNTY BAY where the mutineers landed and which is still the favored landing place. A narrow channel between jagged rocks leads to a tiny, constricted beach. From the beach to the boat-houses a fan-shaped runway of undressed logs provides a hard surface over which the heavy boats may be launched or beached. The Pitcairn Islanders have two types of boats: a heavy whale-boat spacious enough to carry 40 or 50 passengers and a light dug-out designed for one or two men



CAPT. BLIGH of the *Bounty*, whom mutineers forced to sail 3618 mi. in an open boat

ALEXANDER SMITH, alias John Adams, Able seaman on the *Bounty* and for 29 years patriarch on Pitcairn



Courtesy of Joseph H. Beattie

(Above) H.M.S. BOUNTY, from a painting

(Below) FOUR GENERATIONS OF PITCAIRN ISLANDERS. Parkins Christian, great-great-grandson of Fletcher, is seated on the right. His wife is on the extreme left. With them are their daughter and son-in-law, their grandchild, and Mrs. Parkins Christian's aged mother who when this photograph was taken was 87 years old and the oldest inhabitant of the island



THE CHRISTIAN SUCCESSION

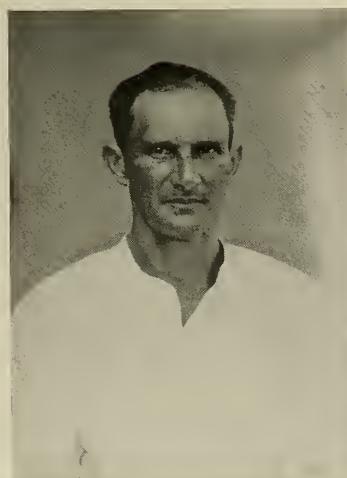
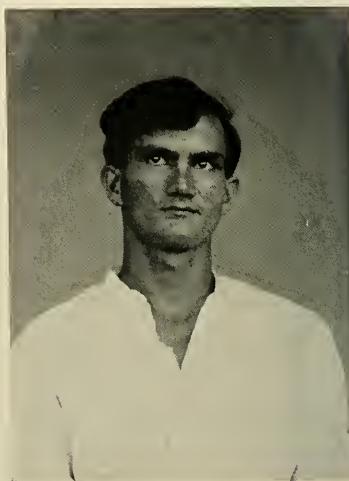
FLETCHER CHRISTIAN, the leader of the mutiny, was a member of an ancient Manx family. He was described by a contemporary as having an ardent nature and being "one of the most foolish young men . . . in regard to the sex." The first child born on Pitcairn was the son of Fletcher Christian. He was named Thursday October, presumably in honor of his birthday. The infant Thursday October grew up to be a strapping man who won the admiration of visiting seamen for his strength. He in turn produced a son whom he named Thursday October. The second Thursday October sired a large family of sons and daughters. One son, Francis or Frank, begot Parkins who was the chief magistrate of Pitcairn when the author visited the island.

Mutineer	Fletcher Christian
Son. Thursday October Christian	
Grandson, Thursday October Christian II	
Great-grandson	Frank Christian

Great-great-grandson Parkins Christian



THE POPULATION on Pitcairn represents the 4th, 5th and 6th generations from the six original crosses between British sailors from the *Bounty* and their Polynesian wives. From these six Anglo-Polynesian unions 150 years ago there are today over 1000 descendants on Pitcairn and Norfolk Islands and in Australia and New Zealand



THE MEN AND WOMEN shown here are all Pitcairn Islanders. They illustrate the range of type found on Pitcairn. The women on the lefthand side of the page favor the Polynesian side of their ancestry. The woman in the lower righthand corner is definitely European in appearance





(Above) A TYPICAL PITCAIRN HOUSE. The older structure has been added to and partly reconstructed. Formerly pandanus thatch was used to cover the roof, but now corrugated iron is preferred for its greater durability and its usefulness in catching rain water. The porch shown on this house is a modern innovation



THE ORIGINAL CONSTRUCTION of a Pitcairn house is easily visible in the photograph above. Heavy foundation logs rest on stones. Uprights were sunk into these logs and boards were slid into grooves cut into the opposing faces of the uprights. By such means the early islanders built their houses without the use of nails

(Right) USUALLY IN A SHED attached to the house or slightly apart from it, the kitchen was built. Smoke escapes through the wide cracks in the wall. Here one can see a simple open hearth and a cement oven with an iron door



(Left) THE ISLANDERS are called to church by this bell suspended just outside the meeting house door. But it also has secular purposes. When men are needed to man the boats, to attend a meeting, for aid in an accident, a special signal is sounded on the bell. The arrival of a ship is likewise announced by this means so that every islander may prepare his load of curios and fruits which he hopes to sell aboard the visiting ship



PITCAIRN is so small that transportation is not a serious problem. But some things must be hauled: wood for fires and the crops from the plantations. For these uses the wheelbarrow on the left is employed. It is low and underslung and nicely adapted to the steep paths of the island

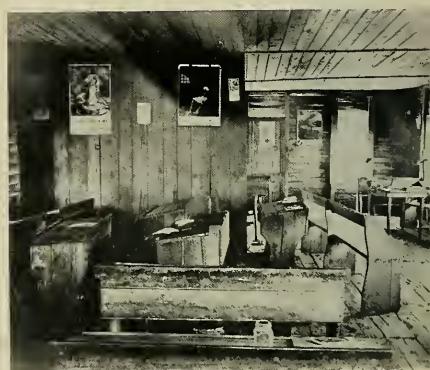
(Right) THE CHURCH or meeting house of the island is a two-story building and the largest on Pitcairn. Services are held here every Saturday, according to the tenets of the Seventh Day Adventist Church, of which the islanders are adherents. Besides three sabbath services, additional meetings are held during the week. The church is the social center of the islanders and its affairs are conducted on a purely democratic basis. One of the islanders usually officiates as the pastor



(Left) THE PITCAIRN SMITHY is one of the few structures left with the old thatch still intact. The smithy is common property. The anvil is a relic of the *Bounty* and the vise comes from a ship that was wrecked off Pitcairn many years ago. A fine may be levied upon anyone destroying or removing the equipment of the smithy



THE INTERIOR of the school house is shown on the right. Forty-four scholars from 6 to 16 years of age and four teachers are accommodated here. The curriculum is limited to the fundamentals. The headmaster is Roy Clark, an American who was taken as a boy to Pitcairn. He receives £3 quarterly. Funds with which to run the school are obtained from the church treasury. Text books are secured from friends in England and America





THE PITCAIRN GIRL shown above is weaving a basket over a wooden form. During their spare moments the women and girls busily plait baskets and hats which they attempt to sell aboard the occasional steamer which stops briefly at the island. The women become so skilled that like the old-fashioned knitter they can carry on a lively conversation without interrupting their work

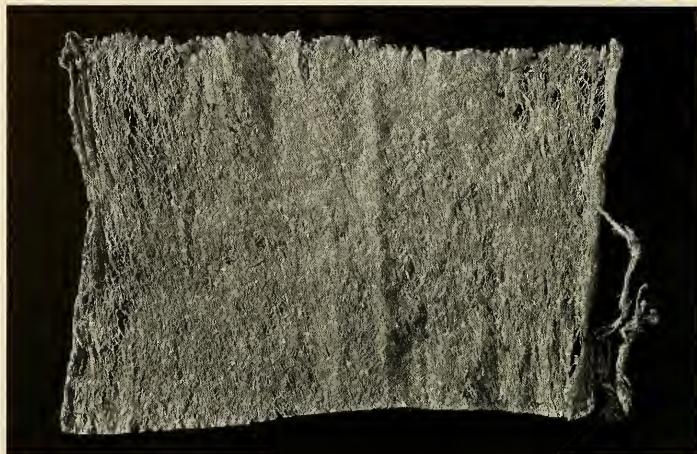
(Right) THIS is the finished basket whose early stage is shown above. It is double, the inner basket being plain. The tourist touch is plainly visible in the word Pitcairn which is woven into the blue and white design. The fiber employed for baskets and hats is the pandanus leaf which is put through a bleaching and scraping process before it is ready for use



THE ABOVE is a collar-box fashioned from and inlaid with wood from Pitcairn. Such specimens of Pitcairn handicraft are sold to the passengers and crew of passing ships. The only source of income open to the islanders is from the sale of such curios and fruits

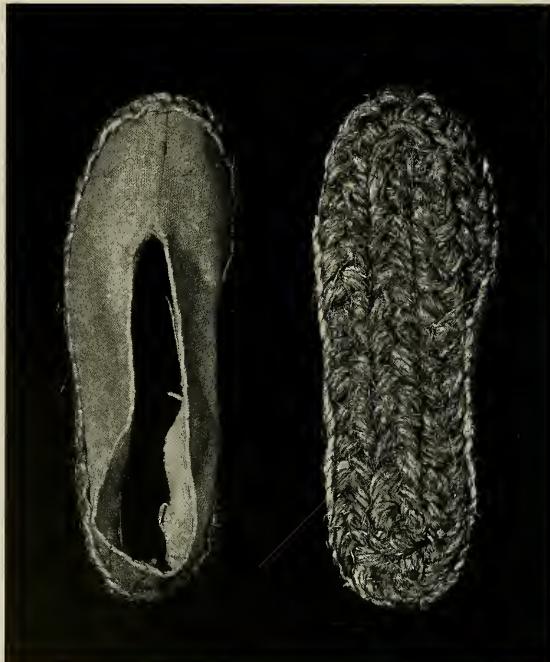


TAPA, a kind of paper cloth made from tree bark, was formerly the only source for clothing and bed linens. Nowadays, textiles from England and America have completely replaced this ancient Polynesian product. Here is figured a small remnant of a crude form of tapa once made on Pitcairn. The making of tapa is now a lost art



THE PHOTOGRAPH on the left illustrates a more ambitious form of curio manufactured on Pitcairn for the slim tourist trade. It is made of the native miro wood and apparently is intended as a kind of wall bracket. First roughly shaped out on a lathe, it is given its finishing touches by hand. Most of the men on the island occupy their leisure moments in such forms of wood carving

LEATHER SHOES are preferred on Pitcairn but they cannot always be easily obtained. Especially in earlier days, shoes were hard to get. The islanders supplied their need by making these rope-soled canvas slippers which recall those used by southern Europeans and by sailors. The pair shown in the accompanying photograph were made by Frank Christian and presented to Dr. Shapiro just before his departure from Pitcairn. Women, perhaps because of vanity, rarely are seen wearing this type of foot gear, although the men still not infrequently use it



and 25 children, the progeny of the various mutineers.

This minuscule world, half English and half Polynesian, increased with such astonishing rapidity that by 1831 the community consisted of 87 members. In that year a disastrous attempt to establish themselves in Tahiti brought tragedy into their lives. But, returning again to Pitcairn, they continued to multiply rapidly. Twenty-five years later the entire group contained 187 men, women and children. This rapid increase of number on an island two miles by one made acute the dread of over-population which haunted the minds of the leaders of the community. Consequently, at their own request the British government removed in 1856 all the Pitcairners to Norfolk Island, over 4000 miles to the west. But homesickness soon overcame several of the transplanted families. And in 1858 a small band returned to Pitcairn and was joined four years later by another contingent. By 1865 Pitcairn had thus been repopulated with 45 inhabitants. Seventy years later, in 1934, this number had increased to 202, almost five-fold.

Today the descendants of the mutineers of the *Bounty* live in two separate colonies. The larger one occupies Norfolk, the other still continues to dwell on Pitcairn. I have had the good fortune to visit both these settlements, Norfolk in 1923-4 (see *NATURAL HISTORY*, Vol. 28, No. 3) and Pitcairn in 1934-35, while on the Crocker Expedition.

A study in heredity

My object in visiting both Norfolk and Pitcairn was to gather data on the biological consequences of race mixture. Under ordinary circumstances, this is a subject encumbered with various extrinsic considerations that tend to obscure the underlying biological forces. Miscegenation often occurs, for example, between individuals who represent selected strains in their respective populations. Frequently the hybrid group is saddled with an intolerable burden of social stigmata, leading to social and psychological degradation. Often the mixture takes place between groups of rather similar people with overlapping characters, thus masking their genetic behavior. Moreover, with few exceptions racially mixed groups, unless of very recent origin, are hopelessly obscure genealogically. And since genealogical clarity is of manifest importance in genetic analysis, its absence leads to the inexorable demonstration of a Gertrude Steinian circle proving that a mixed group is a mixed group.

On Pitcairn, to the contrary, these disabilities are absent. The physical characteristics of the parent

British and Polynesian stocks are diverse enough to throw into relief the heredity of their offspring. The population, living in isolated abundance, have escaped the debilitating effects both of social and economic depression. The habit, established in the beginning of their corporate existence, of recording the births, marriages and deaths in the community has served to accumulate an exact body of genealogical data of immense value in the study of the genetics of the Pitcairn Islanders. And finally, the evidence indicates that the original participants of this genetic experiment were normal individuals of good health.

At present the Pitcairn Islanders are in the fourth, fifth and sixth generation from the original cross. In the absence of social or economic stratification or segregation, they have inter-bred without hindrance. Although the first generation of hybrids started with an evenly divided ancestry—half British and half Tahitian—this proportion has since become altered. Speaking figuratively, a somewhat greater percentage of British than of Tahitian blood now flows in the veins of the islanders. During the 19th century three Englishmen and three Americans joined the colony and, by intermarrying with the islanders, have contributed to the overweighting of the British ancestry of the islanders. A few additional infusions of European blood have occurred, but these are as yet of minor consequence. Back-crossing with Polynesian has, on the contrary, been very rare. One of Fletcher Christian's sons married the Tahitian widow of a mutineer and another son married a Tahitian girl who had been taken to the island as a child. But until recently no other instance of marriage with a Tahitian or a Polynesian occurs in the record. In 1934, however, a young man from Pitcairn returned from nearby Mangareva with a Polynesian bride.

Stature

Taking the Pitcairn population as a whole certain interesting comparisons can be made with their ancestral stocks. For stature we fortunately have, in addition, some extremely valuable early records. In 1825, Captain Beechey visited Pitcairn and his ship's surgeon made use of the opportunity to take measurements on the population. He discovered that in the F₁, or first hybrid, generation the average stature attained the lofty figure of 5 ft. 10 inches for males. This is 2½ inches greater than the average for Tahitian men and almost 3 inches larger than the average of the heights of the mutineers which are preserved in the archives of the British Admiralty. The modern Pitcairn Islander, however, has receded from this mark. Some sixty adult males

now average about 5 ft. 8 inches which remains slightly superior to the Tahitian or English averages of today.

I shall not attempt to present a detailed technical analysis here of the physical traits of the islanders, but a few additional examples may well be mentioned as illustrations of various types of genetic behavior.

In the length and width diameters of the head, the Pitcairn Islanders oscillate from Tahitian to English dimensions. In head length the average of the Pitcairn men agrees with the shorter-headed Tahitian; in head width, on the contrary, they follow the narrower width of the English.

English	Pitcairn	Tahiti
Head Length 193-198 mm	189.6 mm	188.01 mm
Head Width 150-155 mm	152.0 mm	159.6 mm

Here, then, is evidence of dominance in the heredity of cephalic diameters.

The nasal width of the island men, on the other hand, falls in an intermediate position between the two parental groups. The English means tend to range around 35-36 mm; while the Tahitians average 43.4 mm. The Pitcairn mean is 38.5 mm. The slightly closer approximation to the English figures may well be the consequence of the somewhat greater number of British ancestors in the island genealogies. This type of heredity is commonly found in quantitative characters and it has been explained by geneticists on the grounds of the multiplicity of genes controlling the expression of such traits.

Skin color

Similarly, the Pitcairn islanders, taken as a whole, are intermediate in skin color, although the variation among individuals ranges from fair complexions to shades only slightly lighter than the dark Tahitian. In hair color and eye color, blondness and blue eyes are recessive to the darker shades, consequently dark brown hair and brown eyes are frequent among the islanders. The lighter shades of hair color and blue eyes do, however, occur, demonstrating the genetic truism of the conservation of the gene.

Enough of the genetic behavior of the Pitcairn islanders has perhaps been described to make it clear that they form a kind of mosaic compounded from their double ancestry. Each is a varying mixture of English and Tahitian traits or a "blending" of the two; but throughout, certain dominant trends make themselves evident, as, for example, head lengths coinciding with Tahitian ranges, head widths falling

within English limits and statures slightly exceeding both parental stocks.

When plant or animal breeders wish to invigorate certain stocks they frequently resort to cross breeding. The progeny from such alliances tend to be larger, more fertile and generally sturdier. This phenomenon is sometimes known as heterosis, or hybrid vigor. In certain instances the burst of vigor in the first hybrid generation gradually ebbs away in the later generations. Long before heterosis was defined by modern genetics, students of human populations advanced the hypothesis that the efflorescence of culture and the mingling of human stocks were causally related. It is ironical that Gobineau, one of the sources of modern German racial ideology, should also have maintained that civilization arises only from the mingling of races. But in common with other racial hypotheses of culture, this, too, is extremely difficult to prove.

But what has Pitcairn to do with hybrid vigor and hypotheses on the flowering of civilization? Simply this, that on Pitcairn we may observe the physical as well as cultural consequences of race mixture on a convenient scale. Deferring the question of culture until later, let us examine the evidence of physical heterosis among the Pitcairn hybrids in order to determine whether or not race mixture in man may follow patterns similar to those which occur among lower forms of life.

I have already mentioned that the first hybrid generation on Pitcairn attained the average stature of 5 ft. 10 inches which represented a very considerable increase over both English and Tahitian standards of height. The visitors to Pitcairn a century ago were uniformly impressed by the physical bulk and vigor of the men and women of the island. Today, although the islanders remain a tall people, they have lost some of their inches and are less impressive physically.

Fertility

Physiologically, also, the earlier generations of Pitcairn hybrids displayed an astounding degree of vigor. The F₁, or first hybrid, generation produced on an average 7.4 children per mating. The second generation increased this comfortably large family to an average of 9.1 offspring per mating. In the third generation the fertility fell off to 5.4 and in the fourth has receded even farther to the average of 3.0. By another sorting, based on the year of the mother's birth, I found that those women born between 1815 and 1839 produced 11.4 children per mating—a truly prodigious fertility unexcelled to my knowledge by any other population. Combined with the enormous increase in fertility in these

earlier generations, I also found for the earlier mothers a lower age at birth of the first child and a lower age at marriage, indicating perhaps an earlier physiological maturity. Similarly, the women of the earlier generations continued their child-bearing to the age of 45, while those in the later generations ceased to bear children at the average age of 35. The supreme example of procreative vigor fittingly occurs early in Pitcairn history and is embodied by Maria Christian, who married at the age of 14, bore 25 children and survived three successive husbands.

Thus, both in physical size and in fertility the Pitcairn Islanders illustrate the sudden burst of vigor which often follows on cross-breeding. Lest too wide a generalization be drawn from this particular instance, it should be emphasized that while some examples of race mixture have yielded similar results others have failed to do so.

Although the decline in stature evident in recent generations may be explained genetically, the loss in fertility seems less simple than that. The present birth-rate has dropped below the normal expectations, and in the absence of necessary information on the reproductive life of the islanders it would be hazardous to offer a genetic explanation for this trend.

Inbreeding

One other biological characteristic of the Pitcairn Islanders really merits more than the passing mention which is possible here. After the original crosses by which the Pitcairn colony was established, inbreeding inevitably became the dominant form of mating. The few family lines created by the initial outbreeding and the extreme isolation of their island home forced the young men and women to confine their choice of mates to close relatives. The result has been that the Pitcairn Islanders are distinguished by being one of the most intensively inbred human groups of which we have specific information. After several generations of cousin marriage the population is now all inter-related in intimate degrees of kinship. The genealogy of one subject, for example, contained the name of Fletcher Christian 7 times, Edward Young 6 times, John Mills 3 times, Matthew Quintal 3 times, John Adams once and John Buffett once. This illustrates the complex interweaving of family lines which is common to all the islanders.

Now, inbreeding arouses among most Europeans a feeling of doom and horror. They envisage cousin marriage as leading to dire results and easily recall numerous examples of disastrous consequences from such matings. It is, therefore, easy to understand the commonly felt abhorrence of inter-marriage of

close degree. But in the mild taboo which society imposes on first cousin marriage, the instances in which no harm to the offspring can be detected are usually overlooked. For, as animal and plant experimentation has shown, inbreeding need not necessarily be injurious. That it often is may be attributed not to any mysterious evil inherent in consanguineous mating but to latent defects of which the offspring receive a double dosage, thus bringing to expression characters present in the family line. Where the stock is sound, inbreeding does not necessarily lead to degeneracy as it is ordinarily feared. The work of Miss King, for example, proves that many generations of mice may be successfully inbred.

And for human groups the Pitcairn Islanders similarly demonstrate that inbreeding does not necessarily carry ruin in its train. As a matter of fact, the islanders are physically sound and healthy. They show no evidence of endemic diseases or of congenital stigmata. From 1864 to 1934, 114 deaths were recorded in the Pitcairn Island Register. Of these, the cause of death was given in 89 cases. Accidents made up 21% of the total, the rest were distributed among a variety of common diseases, many of them brought to the island by visiting ships.

Bad teeth

In one respect, however, the islanders take a low score. Their teeth are uniformly bad. The statistics are definitely depressing. Not one adult woman out of 60 examined had a complete dentition. Of the total number of women 32% had lost all their teeth, and 61% had lost ten or more. The dental condition of the men was only slightly better. Of their total number 12% had lost all teeth and 52% had lost 10 or more. This makes an appalling record, but we must remember that until very recently the islanders have been unable to make use of dental science. One wonders what might be the dental condition of an American or English village without any of the resources which are ordinarily available to them. It is difficult to account for this condition of the teeth of the islanders. The adequacy of their diet becomes immediately suspect, but in variety at least their food appeared satisfactory. They are accustomed to eating vegetables, fruits, eggs, fish and some meat. On Norfolk Island where the same dental condition prevails the diet contains more meat and also milk which is absent on Pitcairn. But before the cause of their poor dentitions can be definitely assigned to diet, the chemistry of their food would require analysis.

In seeking causes for the dental deterioration of the Pitcairn Islanders, their English ancestry must

Continued on page 80

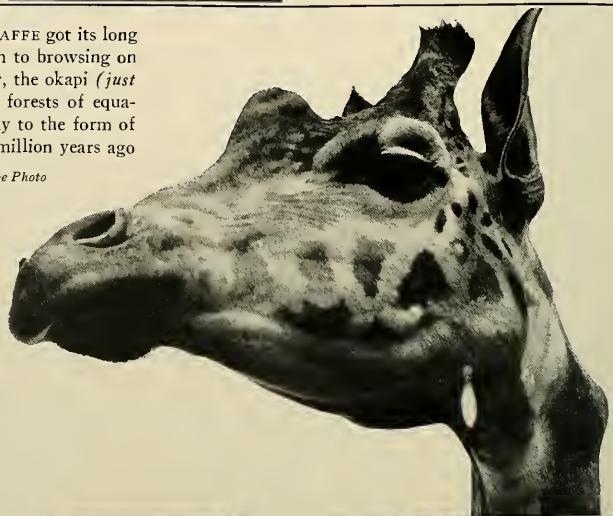


(Left) A PRODIGIOUSLY LONG TONGUE is useful to the okapi in feeding on the lower herbage. This living prehistoric animal is the last and only large mammal to escape the notice of science until the twentieth century

AMNH Photo by Kirschner

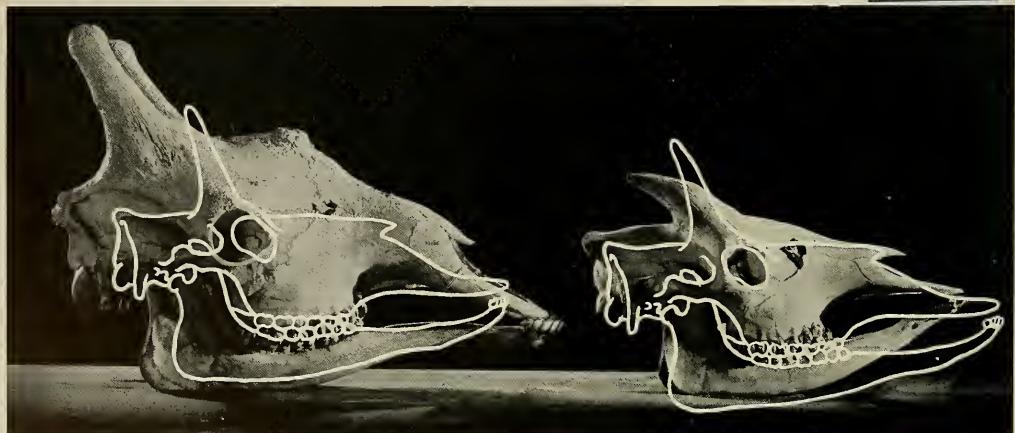
(Right) THE GROTESQUE GIRAFFE got its long neck and legs as an adaptation to browsing on trees; while its living ancestor, the okapi (just above), dwelling in the thick forests of equatorial Africa, held more closely to the form of their common ancestor of 15 million years ago

Globe Photo



(Below) THE OKAPI is more like the earliest members of the giraffe family than his long-necked cousin, as shown by the closer resemblance of his skull (right) than that of the giraffe (left) to their common ancestor, *Palaeotragus* (in outline)

AMNH Photo by Bierwert



THE GIRAFFE AND HIS LIVING ANCESTOR—*Showing that the Okapi, a fossil living 15 million years behind the times, was a giraffe long before his long-necked cousin came into existence*

By EDWIN H. COLBERT
*Assistant Curator of Vertebrate Palaeontology,
American Museum*

RECENTLY there came to New York one of the rarest and most unusual visitors that this city has ever seen. And what is particularly fortunate for the inhabitants of Gotham is the fact that this extraordinary visitor has come to make the city his permanent home.

For on August the third a young okapi, the first of its kind ever to reach the shores of North America, arrived at the Bronx Zoological Park, where it is hoped that he will remain for many years as one of the brightest stars in that firmament of star boarders.

The arrival of the okapi was announced in the papers modestly and briefly. For the most part the gentlemen of the press were content to say that the okapi was "a painted horse of the jungle" or "a weird animal that looks like both a zebra and giraffe but is neither." It is too bad that the newspapers did not realize what a really unique animal this okapi is, for if they had, the newcomer might have been accorded a more pretentious welcome.

An ancient giraffe

The okapi is not a horse, neither is it a zebra, but is most definitely a giraffe, even though it lacks the long neck and legs and the large yellow spots so inevitably associated in our minds with the mute inhabitants of the African veldt and the zoological park. Moreover, the okapi is a giraffe that was entirely unknown to white men until the beginning of the present century—until 1901, to be exact.

EDWIN H. COLBERT's scientific interest centers in prehistoric mammals and their relation to our modern mammals. He has spent most of his six years in the American Museum of Natural His-

tory studying Asiatic fossils, particularly those collected in India by Dr. Barnum Brown and those brought back from Mongolia by Dr. Roy Chapman Andrews. Before coming to the Mu-

As early as 1883 vague rumors concerning the existence of a strange "mule-like" animal, known to the forest pygmies and some of their neighbors as the "O:api," came to the attention of that great pioneer of central Africa, Henry M. Stanley. Stanley passed the legend along (for it was scarcely more than that) to Sir Harry Johnston, then Governor of the Uganda Territory. At the time Sir Harry was unable to do more than show a keen academic interest in the tale, but in 1899 he organized a hunt for the mythical animal. The hunt was unsuccessful except for the fact that Sir Harry was able to procure from some natives a few strips of skin that had been cut from the hind-quarters of the elusive beast. These pieces of skin were sent to Dr. P. L. Sclater in London, and since they showed alternate reddish and white stripes he supposed that a new and peculiar kind of zebra had been discovered.

A scientific sensation

Soon after, however, Sir Harry Johnston managed to get a complete skin and two skulls of the legendary "O:api," and these he immediately sent to Doctor Sclater. It was the zoological discovery of the year, and one of the greatest of all time! For it was immediately seen that these skins and skulls represented an entirely new kind of giraffe, the last and only large mammal to escape the notice of science until the twentieth century.

Of course the discovery of the okapi created a furor among zoologists throughout the world. Doctor Sclater named it *Okapia johnstoni*—*Okapia* (the generic name) being a latinized approximation of the native name for the animal, *Johnstoni* (the

seum he did some collecting in the West, specifically in the Bad Lands. He was sent to Europe by the Museum to do research and is the author of many scientific papers and memoirs.—THE EDITOR.

PRIMITIVE GIRAFFES

SPECIALIZED GIRAFFES

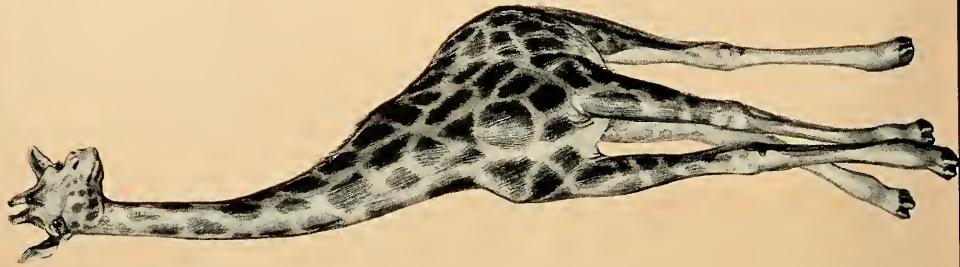
THE GIRAFFE FAMILY TREE

THE OKAPI (*below*) and the giraffe (*at right*) are the only living members of the giraffe family. Both are descended from the prehistoric *Palaeotragus* (*at bottom*).

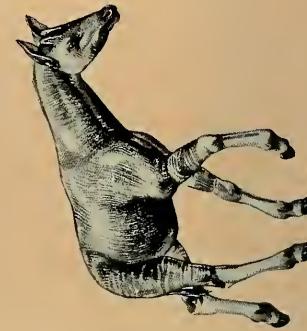
Comparison with the latter shows that okapi is more normal or typical of the family than the vertically elongated, common giraffe. The okapi's legs and neck never lengthened; its horns did not become specialized like those of the giraffe; and its size remains close to that of the ancient *Palaeotragus*. Thus the okapi is a true "living fossil"—a primitive ancestral animal that has persisted on so that it is contemporaneous with one of its descendants.

The earliest giraffes, of which *Palaeotragus* is an example, lived in the Miocene period, perhaps some 15 million years ago. They were closely related to some of the ancestral deer, on one side, and to certain of the primitive antelopes and cattle on the other. Thus the giraffes, deer, and cattle had a common ancestor at some early stage in their history.

DRAWINGS BY MARGARET M. COLBERT



HEIGHT IN FEET



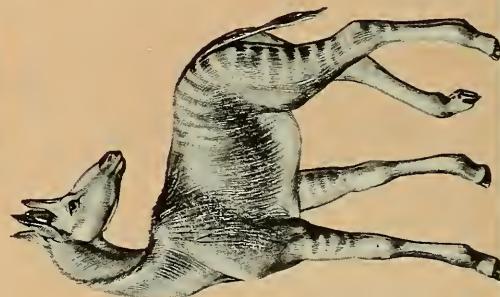


HEIGHT IN FEET



THE LIVING OKAPI is a more primitive and "normal" giraffe even than some of the long-extinct fossil giraffes to which it is related, such as *Sivatherium* (above). *Sivatherium* is typical of a specialized branch of the giraffes, the sivatherines. It lived in prehistoric India, had a heavy, ox-like body and four horns—two short conical ones over the eyes and two very prominent, branching, antler-like horns on the back of the skull. Other sivatherines were *Bramatherium*, which had two gigantic upright horns on the top of the head and two which projected laterally from the back of the skull; and *Hylaphatherium*, whose large horns were joined together to form a single boss rising from the top of the skull. These were truly weird giraffes, which, needless to say, became extinct.

The survival of the okapi is to be explained partly by its isolation in a primitive forest environment and partly by its retiring habits.



specific name) being of course in honor of Sir Harry Johnston. The new animal was discussed at meetings of the Zoological Society of London and at other scientific meetings throughout the world, and many opinions were offered as to its probable affinities.

That it was a species of giraffe was immediately recognized by all competent zoologists. What kind of a giraffe might it be? This was the question that invariably arose in the minds of the numerous authorities who studied the new animal. Perhaps it was some kind of a "degenerate giraffe" that had lost its long legs and its long neck; such was one early theory, a theory soon abandoned. Perhaps it was related to some of the long-extinct giraffes that have been found in various portions of Eurasia; this was a natural inference that came to the minds of many zoologists.

Sir Harry Johnston was one of the first to suggest such a possibility as this. He thought that the okapi might be related to an extinct giraffe from Asia Minor, named *Helladotherium*, and he even proposed the assignment of this name to the okapi. In 1902 Dr. Forsyth-Major, one of the great English students of fossil animals, suggested that the okapi might be related on the one hand to a very primitive type of fossil giraffe known as *Palaeotragus*, and on the other hand to our modern African giraffe, holding a position somewhat intermediate between these two forms. Since that time numerous diverse suggestions as to the okapi's position have been brought forward, but nearly all of them agree on one point, namely, that it is in some way related to the primitive fossil giraffe, *Palaeotragus*.

Now the word "giraffe" may have two meanings. It may be taken to designate the long-legged giraffe so familiar to all of us. Or it may be used in a more general sense to indicate all of the various members of the giraffe family—the Giraffidae—of which the okapi and the African giraffe are the sole survivors. Let us consider briefly the entire giraffe family, most of the members of which lived in dim past ages throughout Asia and in certain parts of Europe and Africa.

The first giraffes

The earliest giraffes lived in the Miocene period, perhaps some fifteen million years ago. They were closely related to some of the ancestral deer, on one side, and to certain of the primitive antelopes and cattle on the other side. That is, the giraffe deer and cattle had a common ancestor at an earlier stage in their history.

It is an interesting fact that the earliest giraffes looked very much like the okapi. They were fairly

large animals, about equal in size to the full-grown okapi, and like the okapi they had legs and necks of normal length. They resembled the okapi, too, in having rather small, simple horns—each horn consisting of a single, pointed spike. What their external characters were—the coloring of their coats, the size of their ears—we do not know, for we have only the fossil bones to guide us in our knowledge of these animals. On the basis of their bony remains, however, they must have been very much like the okapi in their general form and appearance—even to the large, mule-like ears.

These primitive giraffes, which may be called palaeotragines because *Palaeotragus* is the most typical genus, constituted the stem group from which two other groups of highly specialized giraffes were descended, as shown on the accompanying chart. One of these specialized groups may be known as the sivatherines, the other as the giraffines. The sivatherines were large, one might say gigantic, animals with heavy, ox-like bodies and short legs, and almost all of them had tremendous and variously developed horns on their skulls.

How the giraffe got its neck

The giraffines, on the other hand, evolved by lengthening the legs and the neck as an adaptation to browsing on trees. These are the giraffes that we usually think of as being "typical" or characteristic giraffes. As a matter of fact, these vertically elongated giraffes are as far away from the central giraffe type as are the many-horned sivatheres, and they seem typical to us merely because we are acquainted with them.

To get back to the okapi, it at once becomes clear that this animal, far from being a "weird" or "peculiar" giraffe, is as a matter of fact a very normal type of giraffe. It is one of the palaeotragines, one of the primitive types in the giraffe family, an animal in which the legs had not begun to elongate—in which the horns had not begun a course of specialized development. In fact, the okapi is a true "living fossil," a primitive ancestral animal that has persisted on so that it is contemporaneous with one of its descendants. It is an interesting fact, too, that the okapi is not only a persistent primitive type but it is also generally primitive as compared with its palaeotragine cousins. In other words, the okapi is in most respects more primitive than the long-extinct fossil giraffes to which it is closely related.

Why should this holdover from the Miocene Period still be living in central Africa? Why did not the okapi become extinct millions of years ago, when by all the rules he should have passed from this troubled world? These are difficult questions

Continued on page 78

Little-known Chinese Embroideries



RESCUING A LITTLE-KNOWN CHINESE ART—*How an explorer's wife "discovered" a fascinating style of peasant embroidery in far western China, and helped to save it from oblivion*

By ANNA G. GRANGER

As an adjunct to an expedition in search of fossils in the province of Szechwan, China, I suppose no one could have been of less value from a scientific viewpoint than myself. My object each day was to occupy my time in ways that would least hinder the work of the leader. To my great surprise a form of entertainment developed which could not have suited me better. It happened in this wise.

My husband and I were living in a temple which had been occupied by our party for two seasons previously. Friendly relations with the Chinese were already well established. Shortly after my arrival in the winter of 1925-26 a feast was proposed by one of the more well-to-do farmers in the neighborhood. I was invited too. Accompanied by the No. 1 boy we presented ourselves at the appointed hour.

The courtyard in which the guest room was located was alive with women and children, all come to view the foreigners. They were numerous enough to populate a whole district, but were probably mostly members of the one household. Not speaking the Chinese dialect current in Szechwan, I could only show my interest by admiring the babies. This is never difficult in China, as they all have a peculiar charm, a mingling of wisdom and innocence which is hard to resist. On this occasion I was struck by their clothing. Each child wore a good-sized bib or apron of homespun cotton cloth ornamented with intricate patterns done in cross-stitch embroidery. I said to myself, "I must have one of these!"

Our No. 1 boy said that for politeness' sake, none could be purchased on the spot, but that he could arrange to have one brought to our temple on the pretext that I was to have the design copied. Eventually the apron became mine.

Very soon other owners of cross-stitch heard that real money would be exchanged for needlework, and the custom of bringing bundles of specimens for my inspection became established. Some of these were articles of clothing. Others were for household use.

Many were just the width of the loom, 13 to 15 inches, and served as valances around the top of four-poster beds common in Szechwan. Certain shorter pieces always came in pairs, and I learned that these were fashioned to be tied about the three sides of a hard, four-sided block used as a pillow in these parts.

By sewing three breadths of cloth (sometimes four) together a large enough piece was obtained to depict whole scenes. The first one of these that came to my notice fairly took my breath away. I successfully concealed my emotion, having learned that over-enthusiasm on the part of the buyer sometimes stalls the purchase entirely, a thing which happened to me later in the city of Yünnan Fu. Every day something interesting turned up from the bundles brought in by our visitors. I became as eager to look over their contents as my husband was to open up the sacks of fossils which his men brought down from the pits higher up on the mountain.

Even on our walks about the countryside my husband and I were greeted by children who ran out of their homes at our approach, bearing packets of embroidered pieces to show us. We usually suggested that the careful examination of these would have to take place in the temple where the services of our boy, Kan, could be enlisted for the necessary bargaining. One of my most cherished small pieces is of blue cloth with cross-stitching in white. This I spied on the head of a young woman who was doing some outside chores in the lower village about a quarter of a mile from our temple. She had arranged this strip rather broadly and flatly in front so to show the pattern well, while the two ends were folded together at the back and lay gracefully covering her neck. I described this to our Chinese helper, and it wasn't long before he returned from his quest with the coveted article.

Only with one person did Kan encounter any great difficulty in coming to a bargain. This was in regard to what I shall call a wall panel. It was made of three widths of homespun cotton dyed a deep beige color. The design, worked in very dark blue

ANNA G. GRANGER accompanied her husband, Dr. Walter Granger, to China on four occasions during the days of the Central Asiatic Expedi-

tions. Twice she spent the winters with him in a temple near Wanhsien, Szechwan, where she secured the materials described in this article. The story of

these journeys has already been given by Mrs. Granger in *NATURAL HISTORY*.

—THE EDITOR.

cotton thread, represented two maidens whose head-dress and gowns are such as were worn by women in the Tang dynasty. A graceful bamboo tree shelters the pair, and for an example of exquisite rhythm of line it would be hard to find a better composition done in any medium. The man had brought it to the temple. Great was my dismay when I learned that he had also taken it away! Nor did he return, as I had hoped. On the eve of the day before camp was to be broken for the season, I could hardly bear the thought of leaving Szechwan without that particular piece.

Kan was sent to interview the owner, and thanks to his never-failing diplomacy, it is now a part of my collection. I still wonder if some consideration other than a monetary one caused his earlier refusal to sell. I feel that I may have missed here an opportunity of getting a good story, more likely a pathetic one, since this whole region had been raided many times by bandits and soldiers, and the people were miserably poor, having little left of their former possessions.

Once our boy, Kan, took me to call upon an old woman who had a chest full of pieces laid away. I was in search of a special type of embroidery in black on blue cloth to match up with a blue jacket for which I had been unable to find trousers of similar color and style of stitch. The chest yielded the required trimming bands which I later had placed on some white trousers, making me a complete peasant costume. In all the other purchases I selected what appealed to me, not so much because of any definite idea of their usefulness as wearing apparel or as ornaments in a home, but rather because they seemed to me too exotic in design and too wonderfully executed with the needle to warrant their being left bidden any longer in that obscure village.

After reaching New York in 1931, I found that Dr. Carl Schuster was covering the province of Szechwan on a fellowship from Harvard for the very purpose of securing examples of this particular form of Chinese peasant handiwork before it is forced out of existence by the pressure of modern civilization, so-called. There is a boldness, a child-like simplicity and an imaginative quality in their patterns which bespeak a people who were unhampered by the art concepts of the more sophisticated folk in the cities of east and north China. If there was an outside influence, it came in from the west. This is Doctor Schuster's* idea.

At any rate, it is refreshing to see the work of a racial group who were not afraid to let the abstract pleasures of the mind guide them in their construc-

*For a further evaluation of this class of peasant embroideries, the reader is referred to Doctor Schuster's article in *Asia*, January, 1937.

tion of decorative forms. It is easy to see that the designer must surely have had fun in the making of many of the patterns illustrated in the accompanying photographs. And who shall say whether the animal shown at the top of page 56 is a domestic cat or not? It may, for that matter, easily be a somewhat modern variant of the age-old White Tiger of the Western Quadrant, beloved of artists as far back as the Han Period. Does it really matter? It was not intended for a natural history museum.

Some special research was necessary before I found the meaning of the rotund little man on page 57, who may be said to be the patron saint of that most delectable of beverages, tea. He is known as Daruma, and is generally represented without legs because he lost his limbs as a result of nine years of meditation. The following is taken almost verbatim from Mr. F. Hadland Davis' book, *Myths and Legends of Japan*. For a longer account, see Lafcadio Hearn's "Some Chinese Ghosts."

Daruma was said to be the son of a Hindoo king. When he had completed his studies, he retired to Lo Yang, in the province of Honan, where he remained seated for nine years intoning the line "O the Jewel of the Lotus," and exhorting the Blessed One to keep him wholly pure. During this period the sage was tempted after the manner of St. Anthony. He wrestled with these temptations by continually reciting sacred scriptures, but the frequent repetition of the word "Jewel" lost its spiritual significance and became associated with the precious stone worn in the ear of a certain lovely woman. Even the word "Lotus," so sacred to all true Buddhists, suggested the opening of a girl's fair mouth. His temptations increased and he was transported to an Indian city where he found himself among a vast crowd of worshippers in a temple. He saw strange deities with horrible symbols upon their foreheads, and he was surrounded by a great company of dancing girls, and it seemed to Daruma that he met and kissed the woman who had changed the meaning of "Jewel" and "Lotus." Then suddenly the vision departed and he awoke to find himself sitting under the Chinese sky. The sage, truly penitent for neglect of his devotions, took a knife from his girdle, cut off his eyelids and threw them on the ground where they were miraculously transformed overnight into the tea plant. Though gratified at this manifestation of Buddha's forgiveness, Daruma still continued his incantations.

For me, already an ardent devotee of tea, this fanciful tale of pious renunciation has given an added charm to an occupation, always alluring.

No claim is made that any of these cross-stitch pieces are themselves very old. Interest lies wholly in that the designs have been faithfully transmitted from one generation to another for centuries as each succession of mothers taught their daughters to prepare their hope-chests, even as they had prepared theirs. The pity is that now-a-days the ancient motifs are not being repeated with the same exactitude as formerly and soon will be entirely forgotten.



Photo by Walter Granger

(Above) THE TEMPLE in far western China which served as Mrs. Walter Granger's home while she collected examples of a little-known type of peasant embroidery. As wife of the scientist and expedition leader, she was in a unique position to investigate this vanishing art

A CHERISHED POSSESSION. Made of blue cloth with cross-stitching in white, this piece served as a head-dress for a young woman of the village. When the natives heard that their heirlooms were in demand they brought bundles consisting of wearing apparel, valances for their four-poster beds, and other pieces for household use. In all the examples there is a child-like simplicity and an imaginative quality which show these people have not been influenced by the more sophisticated art concepts of the eastern and northern Chinese



AMNH Photo by Charles H. Coles



Walter Granger photo

(Above) MAIN STREET of the lower village at Yen Ching Kou, a few hundred yards down the valley from the temple opposite



Walter Granger photo

(Right) CHARACTERISTIC HEAD-DRESS. If the cloth had a pattern, the strip would be arranged broadly and flatly in front to show the design. The two ends, folded at the back, serve as a neck covering as well





(Left) A DISTINGUISHING FEATURE of Szechuan art is the trick of working in the main idea solidly in black, and accomplishing the decorative effect by leaving the background blank. It is not known whether the cat-like animal in the foreground is a domestic cat or not—it might be a variant of the age-old White Tiger, beloved of artists as far back as the Han Period



(Right) THIS CENTRAL DESIGN decorated a black square of cloth used for holding a baby on the back as shown by the photograph below. Designs of good omen are believed to imbue the baby with favorable influences. The basket stands for felicity in the Western Heaven; the peony means wealth; and the butterfly is an expression of joy. The musical jade (lower center), giving out a pleasant ring, and the bat both portend happiness. They are shown here as items in a cord and tassel attached to the bottom of the basket



THE CHIEF DUTY of this village boy was to carry his baby brother around most of the day. Bands attached to the two upper corners of the cloth cross over his chest and, after passing around the baby, encircle the waist

Walter Granger photo



Walter Granger photo

A CHINESE WAYSIDE INN, where interesting types could be observed: a convenient resting place on the climb up the hill to the bone pits that were being excavated by the expedition

DARUMA, an Indian sage and the patron saint of tea. Penitent for the neglect of his devotions he cut off his eyelids and threw them on the ground where they were miraculously transformed overnight into the tea plant

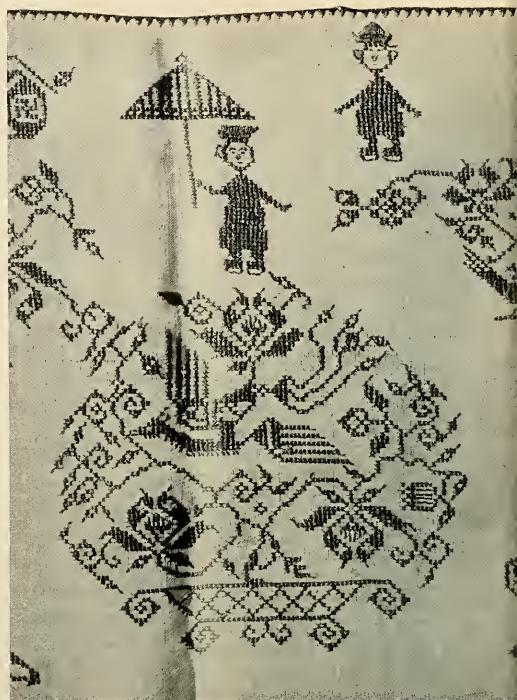
The cloth is a fine illustration of the ability to assemble harmoniously in a given space a great variety of unrelated forms. The non-Chinese face is no new version. A similar portrayal of foreigners who came in from the west is known even as far back as the Han Dynasty





Walter Granger photo

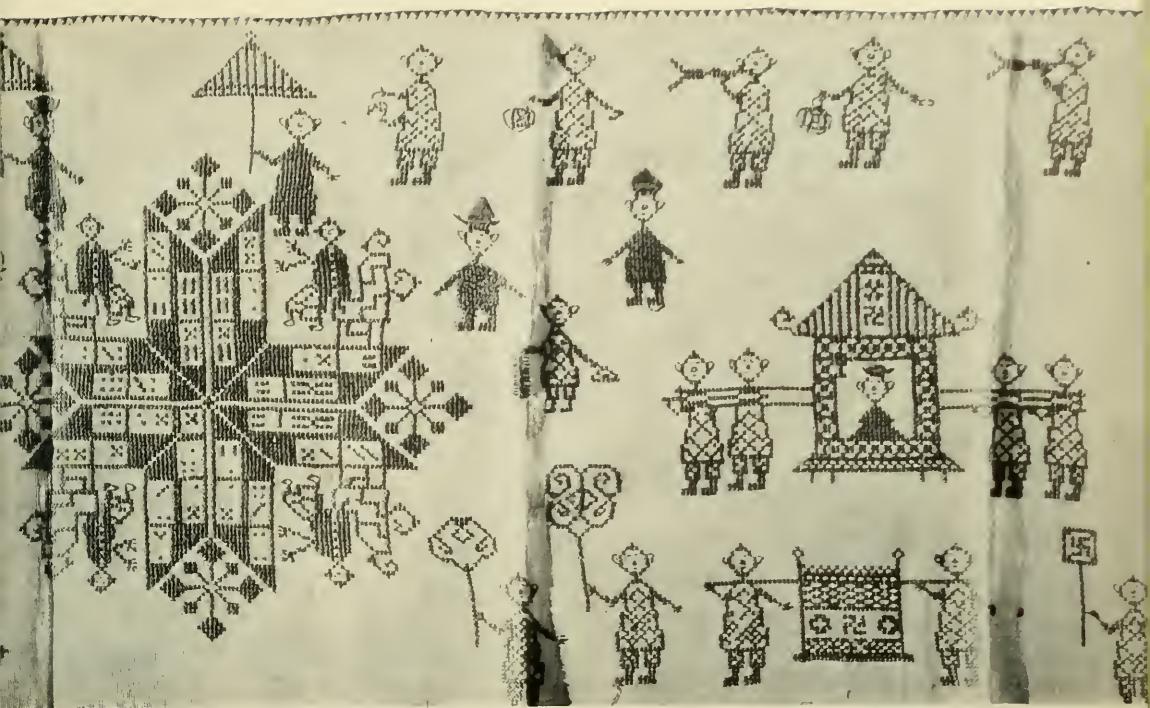
(*Above*) A TYPICAL FARM HOUSE in the region. The large flat bamboo trays are for drying grains and vegetables. The festoon in the upper left is made by sweet potato vines; its leaves are used as food for pigs while the stems serve as fuel



(*Above*) SECTION of a long sampler made by a Chinese amah well versed in the traditional embroidery motifs. In the part here shown interest centers chiefly in the fine medallions. The one at the right depicts ancient game devices suggesting our dominoes

Walter Granger photo

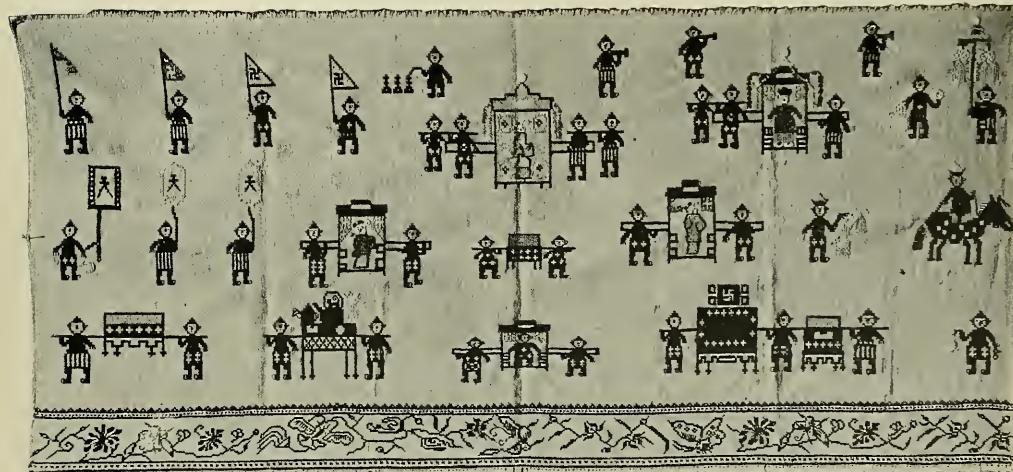




WEDDING PROCESSION: a motif for a door valance made of red wool with cross-stitching mostly in black floss, showing the bride in her wedding chair (center), her attendants, and gift bearers. Among the presents are a tea set, a rattan bed frame and some bed quilts. The man on horse-

back is probably added to lend dignity and to suggest an honorable culmination of the hopes of the contracting parties, he being the well known representation of a person who has successfully passed the triennial literary examination

AMNH Photos by Charles H. Coles

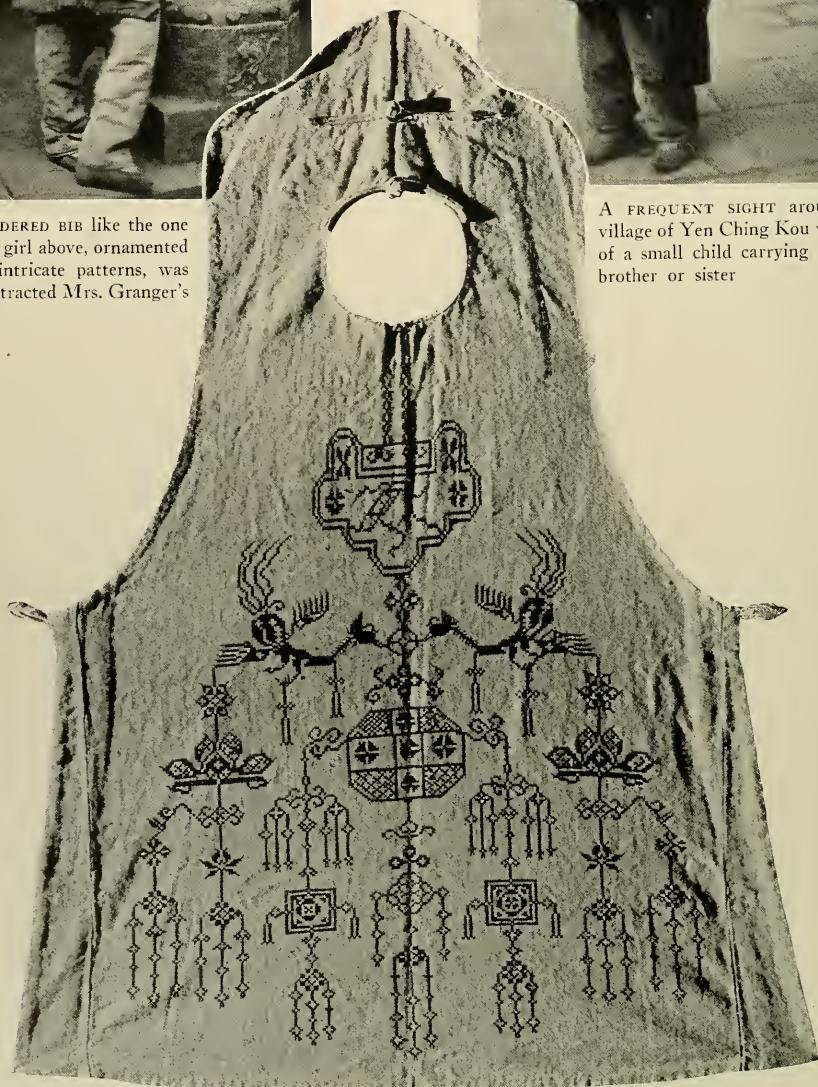




AN EMBROIDERED BIB like the one worn by the girl above, ornamented with such intricate patterns, was what first attracted Mrs. Granger's attention



A FREQUENT SIGHT around the village of Yen Ching Kou was that of a small child carrying its little brother or sister





(Above) CHINESE SYMBOLISM plays an important role in the patterns for the embroideries shown in these pictures. The crane, the peach, hand fruit and pomegranate used in this design are translated to mean "May you have many years, many honors and as many male descendants as there are seeds in a pomegranate."

This design is worked out by an almost solid black cross-stitch on a white background. Note that the knots on the tree are made by omitting stitches at certain intervals

(AMNH Photo by Charles H. Coles)

(Right) YEN CHING KOU VALLEY looking toward the Yangtze. The temple is on the right in the middle distance

Walter Granger photo

(Left) A CHILD'S BIB or apron. The padlock and chain stitched at the neck represents the actual object of brass or silver often worn by Chinese children to chain them to existence and prevent their being ravished by death from their affectionate parents. Below the lock are mythical birds (phoenixes) from which are hanging many ornate tassels, symbols of dignity. The birds are peace loving and will ensure the child a calm and sweet disposition

(AMNH Photo by Charles H. Coles)



HARVEST OF THE SEA-FLOOR—*Each January impressive ceremonies commemorate sponge gathering in Florida water, where the Hellenic traditions of a historic trade persist in the largest unmixed Greek community in America*

By LEONORA B. ELLIS

No other form of zoophytic life ranks in commerce with the sponge, a source of marine wealth long regarded as belonging to the coastal waters of the Mediterranean, particularly in the Grecian archipelago.

During the Epiphany celebration at Anclote, Florida, last winter, a slim young diver who had triumphantly brought up from watery depths the Golden Cross, thrown there by the great Patriarch, was asked: "How long, Michael, have your people been diving for sponges?"

"Two thousand years and more," answered the dark-eyed lad, still all a-shine from the water and from the archiepiscopal blessing. "The Hellenes were sponge-fishing before Christ came into the world."

"But how long here on our southern shores?" pressed the traveler. "I mean in this Anclote region?"

"Ah! since my father was younger than I am—and he is forty-five now—to my seventeen. But sponges are many, and replant themselves if treated fair."

Unknown wealth

However, the first sponge fishers of our continent were not divers. Nor was this part of the world even aware of such wealth in its waters, until the discovery was blundered upon in the middle of the last century, by turtle fishers in the shallow waters about Key West. Another quarter of a century elapsed before the strange discovery was followed up in a practical way. The United States, like the countries of Europe, continued to draw its supply of the important commodity from the Mediterranean fisheries. The Civil War and the ensuing industrial stagnation account for the lapse.

But in the long period of industrial expansion which followed, sponge gathering in the Gulf grew

from a small local industry into an important branch of the fishing trades. Today the American sponge quite adequately supplies domestic demand, while the export of at least one variety, the grass sponge, to the British Isles has assumed important proportions.

In ancient times the sponge was thought to be some kind of a plant, owing chiefly to the stationary and branching habits of the colonies. The sponge has neither legs, wings, fins, eyes, nor other sense organs. Nor has it any of the internal organs peculiar to animal creation. Thus, although the sponge has been known for thousands of years, being mentioned even by Homer himself, its right rank as an animal was not absolutely conceded until the 19th century, and the designation, "zoophyte," which signifies "animal plant" has only recently become old-fashioned.

Endless variety

That the sponge is entirely animal in its nature is shown by its mode of feeding, type of egg-cells and their development, and in other ways more obscure.

Sponges are of endless variety in form and color, size and texture; but all live in the water, chiefly sea-water, attaching themselves either to the bottom or to rocks, coral, shells, or other marine substances. The marine types mostly inhabit the shallower seas to a depth of one hundred feet; few varieties being indigenous to deeper waters. One or two obscure families inhabit fresh waters in various parts of the globe.

Of the best known varieties, many are of no commercial value but are delicately beautiful and fine, like seaweed, gracefully branched, and ranging from an inch or less in length to several feet. One very abundant variety is in the form of a vase, or cup, ranging from the "after dinner" size to a huge stein or vase a foot or more in diameter. The fishermen themselves often call these cap sponges, selling them as curios under that name. The texture of the larger sizes is extremely tough and durable.

The popularly named "finger sponges" are found chiefly in shallow waters, often stretching like a giant many-fingered hand across an oyster bed. The species known as Glass sponges, among which the wonderful little creation known as "Venus's Flower Basket" is an example, receive their name from their remarkably twisted spicules composed of lustrous white fibres of silica, a constituent of glass. These are of diverse sizes and shapes, quaint, or beautiful, and, from an aesthetic angle, are perhaps the most interesting of the entire family.

Sponges as usually found are not single animals but "colonies," often of several or more individuals. The original single sponge, having developed from a minute egg-cell a thousandth of an inch in diameter, and attaching itself to something stable, expands rapidly, and is seen forming new buds, somewhat in the manner of twig formation in plants. Impossible to follow here in detail the process continues to a "many-twigg'd" or many chambered colony. Yet such a study is of surpassing interest, as is likewise the mode of feeding and eliminating through that intricate system of canal-like pores which one may analyze from any skeleton in hand. Skeleton it really is, this commodity known commonly as a sponge. In life these skeletons were filled in and covered over with a soft, jelly-like flesh, the substance of living cells.

While, as stated, sponges are of immense variety and are distributed rather widely throughout the waters of the globe, those adapted to commercial or industrial purposes are limited in distribution and in abundance.

Birth of an industry

When the Key West turtlers had shaken two or three of the noisome, unsightly objects from their nets, some traveler who chanced to be on the docks looked down at the lumpy, uncouth blobs, and straightening up, said, "Sponges." Nobody there dreamed that this was the birth of an industry. It was 1857, and the Key Westers, a small and motley population known colloquially as "Conchs," were slow to try anything new. Wasn't turtling good enough?

It was twenty years after the close of the Civil War before the little fleet of sponging vessels began to be noticed dotting the semi-tropical waters engirdling the island-city, which was still more Cuban than American. By this time almost all domestic markets were offering American sponges alongside the Mediterranean varieties, the former hardly so fine, certainly not so well processed, as the latter.

But the Conch fleet grew to a hundred taut vessels, venturing farther from the island shallows and

using longer and longer hooking poles to twist loose the superior specimens from deeper waters. The market demand grew as the industry climbed to show better competition. For a brief score of years Key West became the sponge capital of the western continent.

But it had dawned on shrewd minds that the really superior varieties of the commodity, the finest of the sheep's wool sponge, which were used in surgery as well as for toilet purposes, grew in the deeper waters, also that the richest beds lay farther up the coast of Florida. For invading these richer beds the Key West industry was simply not mechanized. The Conchs had fished altogether by the hook-and-pole method, that is, with a sort of hook, or fork attached to a long, quite cumbersome pole. Few Conchs, even the most expert, could manipulate a pole exceeding forty feet in length.

The battle was soon on: out-dated methods fell before the new.

Greektown

One enterprising man brought two lateen-rigged boats, two diving suits, and four Greek divers from a Mediterranean port, and set up a new era, a new plant, at Tarpon Springs, half way up the west coast of Florida. This was in 1905. Within six years there was a colony of 2000 Greeks at Tarpon Springs, and lateen-rigged sails were thick as cat-boats in the mid-Gulf, appearing, disappearing on golden horizons. Diving helmets and armor became commonplace in the Anclote harbor. Swarthy men of alien speech were swarming about the port, their women and children soon beginning to follow, and little new homes went up by twos and threes in a section of the winter resort town which took the name of Greektown. A vast warehouse of curious construction was built on the waterfront to house the abundant marine harvests brought in by the ever increasing Greek fleet. A million dollar sale on the dock beside it was not a record breaker.

The queen city of the islands had lost its leading industry, and Tarpon Springs was henceforth the sponge capital of the western continent. The age-old grapple invariably ends one way. Skilled labor pitted against unskilled, superior mechanism against inferior, none need ask the victor.

The industry has had its ups and downs here as in the Mediterranean. World war, world depression, the repatriation of hundreds of the most skilled divers under summons to the colors of Greece. But the sponge fisheries of Florida count high among Southern industries today. And this industry has a future rather than a past. Sponges of the Mediterranean, where indeed the beds are seriously depleted,



(Above) SPONGE CAPITAL of the Western Hemisphere: the harbor at Tarpon Springs, Florida. When the wealth of these sponge-fields was realized in 1905, expert Greek sponge divers whose ancestors had plied their trade for 2000 years in the Mediterranean, flocked to this gulf port, establishing the largest unmixed Greek colony in America

(Right) A MILLION DOLLAR sponge harvest is no record-breaker on this Tarpon Springs dock.

The commercial sponge is the skeleton of a creature whose biological classification puzzled early scientists. Not until the 19th century did it rank as an animal and only recently has the term "zoophyte" (animal-plant) been considered out of date



(Right) THE OLD WAY: surface fishing for sponges as practiced by the Cuban fleet. The man in the stern locates the sponges through his glass-bottomed bucket, then wrenches them from the sea-floor with the long, hook-tipped pole on which his foot rests. The oarsman unhooks the sponge when it is brought to the surface. This was how the "Conchs" (American Key West fisherman) went about the job during their 20-year hegemony of the new-born American sponge industry prior to 1905



BETTY LEE

(Right) THE NEW WAY: modern diving helmets only added to the efficiency of the Greek immigrants, accustomed for centuries to dive for their sponges. The latest mechanical apparatus in the hands of a people born to the trade spelled doom for the Key West industry and its primitive methods. Moreover, the richest sponge fields, containing such fine types as the "sheep's wool" sponge used in surgery, lie more than a league from shore where surface fishing is impractical



(Below) HELLAS COMES TO FLORIDA. Each January thousands gather at Tarpon Springs to witness the impressive celebration of the Greek Epiphany. Gregorian chants echo across a new world, a white dove is released, and slim Greek youths dive competitively for a shining cross. Clinging determinedly to their religion, these historic sponge fishermen are now building the largest orthodox Greek Church in America



are less in demand on the American market each season, perhaps scarcely at all except for the conventional requirements of surgery.

And the Florida fleet, with its 125 taut vessels making Anclote their port, has many bold seamen and divers adventuring into ever deeper waters in quest of the finer, higher-priced specimens, which cling to the sea floors there, the delicate-fibered sheep's wool in full, free growth. It is not to be inferred, however, that they are prone to pass by less valuable kinds if there is still room in their bags.

The grass sponges rank next to the wool in commercial value, much coarser, darker, but of enduring quality and tough fiber. New uses are constantly being found for this variety in the modern industrial arts, besides their increasing export to England's mattress factories.

A small fleet of sponging craft still makes Key West its base, the island fishermen being still equipped with their primitive implements but bringing in fair-sized harvests of the grass kind and similar coarser varieties.

Through many of the state's legislative sessions, the "wrongs of these disinherited toilers, exploited and robbed by foreigners" furnished the theme of much regional oratory. The result was that within a few years after the coming of the divers a statute was enacted forbidding the aliens to get sponges inside the three-mile limit. This enactment was in strict accord with the spirit of protective legislation, since undeniably the heavy tread of armored divers must injure the budding zoophytes. "But," said the laughing-eyed Greeks and the investors behind them, "why grumble, since in these shallow seas our profitable fields lie usually a league or more from shore?"

The colony of divers at Anclote, with their usually large families, is the largest unmixed Greek community in America, and probably the richest, with their banks, schools, chapels, their places of

amusement and clubs. In their coffee-houses rows of quiet-eyed men may always be seen at night, sipping the thick black coffee between puffs on their long-curved pipes, or Turkish narghilehs.

Not only have these people brought with them their customs and ways of living, along with their traditional trade, but they cling to their native tongue, and supremely to their religious faith. They are now erecting the largest cathedral of the Orthodox Greek church in America. The celebration by them of the Greek Epiphany each January now draws a great throng, not merely of other Greeks throughout the western world, but of churchmen from far and wide, of travelers, and even the merely curious from abroad.

This impressive ceremonial, always conducted by the Greek Patriarch, is perhaps better known as Greek Cross Day. At the conclusion of the Epiphany services in the church, begun at sunrise and continuing until midday, the entire congregation follows the prelate and his company of priests and neophytes to the water-side, where already thousands of visitors are collected. The Gregorian chant bursts forth, resounding across the blue expanse, a white dove is released, and the golden cross is hurled by the Primate into the shining depths. A dozen slim youths strike the surface at the same time, the most fortunate one coming up with the sacred emblem held high above his head, then hurrying to kneel before the prelate for his especial blessing.

Another name of the beautiful and awe-inspiring ceremonial is the Blessing of the Waters. For at the close of the rites the Archbishop pronounces a final invocation upon the boundless seas rolling away to the horizon, blessing the waters, and praying that the blessing may in turn envelop all these men who must go down to the deep in their frail craft, drop to its floors, and wrest therefrom the harvest that mean daily bread for them and theirs.

APPLICATION FOR MEMBERSHIP IN THE AMERICAN MUSEUM OF NATURAL HISTORY

Membership Secretary, THE AMERICAN MUSEUM OF NATURAL HISTORY
79th Street at Central Park West, New York, N. Y.

Please present my name to the Membership Committee for election as an Associate Member and find enclosed \$3.00 covering dues for the next twelve months.

I understand that I am to receive NATURAL HISTORY MAGAZINE each month except during July and August, my members' card for admittance to the members' room, my certificate of membership showing the date of my election.

Cheques made payable to the Treasurer, AMERICAN MUSEUM OF NATURAL HISTORY
THE AMERICAN MUSEUM reserves the right to reject any application

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THE INDOOR EXPLORER

Museum Rarities and Irreplacables

TINGMISSARTOO, the seaplane that Charles Lindbergh flew "north to the Orient"; Lincoln Ellsworth's rifle, his oddly spiked shoes, and the other arctic exploration equipment that meant the difference between life and death; the sturdy sledge that Peary rode to the goal of his long and arduous career; another sledge that brought Amundsen to the South Pole—all these are Museum exhibits that cannot be duplicated. They are irreplaceable.

Any indoor explorer in the American Museum might well wonder whether there were not other things, less conspicuous perhaps, but nevertheless so rare that there could be little or no likelihood of replacement. Inquiries brought results that surpassed all expectations.

In the Mexican Archaeological Hall, for instance, there are a number of objects on display the like of which probably will never be found again. On entering, the room will seem filled with large and imposing pieces of sculpture, pottery groups and cases of prehistoric implements. But sooner or later you will be attracted to a display of exquisite jade carvings, among which there is a small, daintily carved figurine of a tiger-faced, or more properly, ocelot-faced deity. Even the untrained layman will recognize it is a masterpiece of the jade-worker's art. This beautiful statuette, oddly enough, was not brought to light during an archaeological expedition. As is so often the case with such rarities, it was unearthed as an unlooked-for by-product of commercial excavation.

In 1909 they were constructing a dam for the power plant at Necaxa, Mexico, in the mountainous region of northeastern Puebla. An American engineer who was working on the project was supervising the leveling of a mound by hydraulic pressure. The powerful instrument sliced out a steady stream of thick, drab mud. Suddenly a glittering speck in the fast-spreading muddy pool caught the engineer's eye. What he rescued from oblivion was this fascinating bit of jade work that now lies in the American Museum. How great a wealth of similar archaeological jewels may lie in profusion at this spot near Necaxa will, in all probability, never be known, for the engineer had no chance to look further. The water behind the dam was rising rapidly. Today more than 60 feet of it prevents any further research at the site of the discovery. But this is an old story to the archaeologist and the fossil hunter. Whenever it is a question of the progress of contemporary civilization, versus the remnants of prehistoric times, the "diggers" must inevitably lose out. It is a scientific certainty, for instance, that if the city of Paris or of Buenos Aires could be completely excavated, the

diggers would find in a few weeks treasures such as they could hardly hope to unearth in a lifetime of search among less populated fossil fields.

The neighboring South American Hall contains what is perhaps the Museum's most grisly exhibit, and to the more sensitive visitors the extreme unlikelihood of its duplication will doubtless seem just as well. This is the celebrated "Copper Man."



The Copper Man, who was once thought to be a Copper Woman, might best be described as an accidental mummy. Long before the days of the Spaniards (how long before, scientists have been unable to tell) the Copper Man was a primitive Indian copper miner in what is now Chuquicamata, Chile. While he was engaged in his perilous occupation, something went wrong, and the Copper Man became the victim of one of the earlier mine tragedies on this side of the globe. Thousands of similar prehistoric tragedies may have occurred, but time has obliterated most of the evidence. The tragedy of the Copper Man was preserved for posterity by the peculiar conditions under which it occurred. Since he met his death in a mine rich in copper ore, his body was subjected to the chemical action of the earth in which he lay. This earth contained anhydrous sulphate and blue vitriol—substances which prevented the rapid decomposition of his flesh. The surface of his skin is coated with a grayish-green coppery covering. Except for his chest, which is partially caved in, the main features of his body are intact and, oddly, his hair and fingernails are in nearly perfect condition. The same cannot be said of the Mummy's innards. It was discovered recently when the Copper Man was removed from his case to be photographed that the innocent-appearing outer shell of his body was the receptacle of an evil-smelling fluid which seeped to the surface at several points and made him, although they had no trouble at all about the pose, an exceedingly trying photographic subject.

When your Indoor Explorer consulted Dr. Walter Granger, Curator of Fossil Mammals, he found that veteran scientist chary about labeling any of his department's collections as absolutely irreplaceable.

"Time alone can tell," said Doctor Granger. "In some places erosion of the soil is so rapid that deeper beds are disclosed and specimens considered rare at the time of their discovery may be duplicated a few years later."

"Then the condition of the soil in which the individual fossil is found is a pretty good clue as to how long it will remain a rarity?" asked the writer.

"Yes, it does give you something to go on," replied Doctor Granger. "If we find some fossils in a locality where the weathering away of the soil proceeds at a very slow pace, say one inch in every twenty years, we have some reason to believe that they won't be duplicated for quite a while. The field would be pretty well taken care of as far as surface picking goes and the next expedition would have to dig deeper than we did if they expected to unearth anything of great value."

"I suppose, however, that there's always a chance of somebody digging just the right place," suggested your Explorer.

"No doubt about that," Doctor Granger said, "there are lucky strikes in fossil hunting just as there are in everything else. That's why I'd hate to say anything we've got can't be replaced."

But Doctor Granger was willing to admit the rarity of a certain duck-billed dinosaur that goes by the name of Trachodon. This specimen is a sort of dinosaur mummy, taken with his skin almost intact. This latter fact gave scientists their first clue as to what dinosaur skin was really like. Early reproductions of the giant animal pictured him with a scaly, dragon-like skin, but the unearthing of Trachodon definitely scotched this theory. From his skin it was learned that dinosaurs wore a rather leathery hide covered with small spots about an inch in diameter arranged in a mosaic pattern. Trachodon's skin was thoroughly faded, but it is a reasonable conjecture that the living animal was decked out in some sort of color scheme. The Explorer went down to the exhibition hall to see Trachodon and found him lying on his back, his feet indecorously poised in the air. Doctor Granger explained that this posture was arranged the better to show off his underparts which are the best preserved sections of his epidermis.

While in this Hall the writer was shown the Museum's specimens of the *Embolotherium*—a gigantic beast deriv-

ing its name from the battering-ram-like nose which was its principal weapon. This strange titanotherium is a first-rank rarity despite the fact that there are one or two other specimens in existence. Doctor Granger is particularly proud of his unusually complete collection of Paleocene mammals, accumulated during a long period of pioneer research by Museum expeditions. He is reasonably sure that no collection of similar size and completeness will ever be gathered hereafter.

"It is undoubtedly the best collection of its type in the world," declared Doctor Granger. "Other institutions can have little hope of equaling it because we have made such a good start and because we are continuing our activities in the Paleocene fields."

Bird-lovers will discover in the Museum's Department of Ornithology many specimens which, if not absolutely irre-



placeable, are certainly very rare. Such extinct species as the Great Auk are represented in the Museum's collection, and of the forty existing specimens of the long-extinct Labrador Duck, Museum ornithologists are in possession of seven. Although the passenger pigeon, once extremely prolific and now also extinct, is represented by many mounted specimens both in this and in other museums, there are only a half dozen or so clear photographic negatives showing the bird alive. All these negatives, which were taken by the late Professor Whitney, were presented to the American Museum by Dr.

Frank M. Chapman, Curator of Ornithology. Doctor Chapman characterized these photographs as being among the priceless possessions of his Department.

When your Explorer heard the word "priceless" his thoughts turned immediately to precious gems. Accordingly, he set his course for the Gem Hall where, under the expert guidance of Curator Herbert P. Whitlock, he was shown some of the dazzling irreplaceables in the Morgan Collection. Here the far-famed Star of India weighing 563 carats—the greatest star-sapphire in the world—glows with an extinguishable blue flame. In another quarter, an 88-carat emerald engraved with floral designs is remarkable both for its incomparable beauty and its unusual history. It was first discovered in Colombia, South America. About three hundred years ago, however, it was transported across the Pacific to India during the occupation of that country by the Mogul followers of Genghis Kahn. It was in the city of Delhi that the stone was incised with the delicate carvings that now appear on its surface, and after this process had been completed it became the turban ornament of one of the Mogul princes.

As we walked along, Mr. Whitlock pointed out several other rare jewels including the unique turquoise slab dating from the fifteenth century and meticulously engraved with an entire chapter from the Koran. Worth a king's ransom, any of them; and it is likely that in their time many of these gems may have served as such.

"I should imagine," observed the writer, "that visitors are forever begging you to tell them the romantic history of these jewels."

"You're quite right," replied Mr. Whitlock. "Only the other day a lady came to me with the request that I tell her the history of one of our emeralds. I did so, and had no sooner finished than she pleaded with me to tell her another story. 'Madame,' I said, 'that is impossible. As curator of gems in the American Museum, it ill befits me to become a second-story man.'

Big game fishermen strolling among the Museum's fish exhibits during the off season can measure the catch they have always dreamed of making against the splendid assortment of big game fish presented to the Museum by sportsman-author

Zane Grey. The donor of this collection is one of the most intrepid sportsmen of the deep, and his catches on display in the Museum reveal the vast amount of time and energy he has devoted to his hobby. From this group the fish-fancier may pass on to other wonders such as the more than one hundred small fish taken in remote corners of the earth which could be duplicated only at prohibitive expense. Then there is the mounted whale shark, an irreplaceable specimen of a very rare species.

It is improbable that anything approaching the scope of the deep sea illuminated fish exhibit, which was modeled from the collections of Dr. William Beebe, will ever be assembled again; and authorities doubt that a Manta Ray as huge as the one whose plaster model adorns the Fish Hall is likely to be captured for many years to come. Rarest of all is the model of the deep sea angler fish with its parasitic male attached, which came to this Hall by way of the British Museum in an exchange of gifts.

Not content to rest on the laurels it has already won for its display of unique and rare objects, the Museum recently opened to the public the largest exhibition hall possessed by any museum in the world. This is the Hall of Ocean Life which has been revamped to make room for the presentation of new rarities. Here you will find on temporary exhibition the strange globular Bathysphere in which Dr. William Beebe crouched as he explored the depths and watched deep sea life in the Bermuda waters. You can examine its walls, four inches thick and built to withstand the tremendous pressure of many tons of salt water. You can look within the chamber at the oxygen tank which had to function perfectly a half mile beneath the surface.

Strolling into another part of the Hall, you will be unable to restrain an involuntary expression of delight at the sight of what is certainly, even from a distance, one of the most beautiful exhibits ever created anywhere. It is the Bahaman Coral Reef Group, designed by Dr. Roy W. Miner, Curator of Marine Life, and erected under his direct supervision by Chris Olsen and others of his staff as the result of five expeditions made to the Bahamas under his leadership.

The Coral Reef Group was exclusively



a product of Museum workmanship, from start to finish. So much time (more than 12 years) and so much collective skill and ingenuity were required to deal successfully with its intricate construction problems, that it is doubtful if a similar project will ever be undertaken in the future. Now, there is only one way to observe the upper section of this magnificent creation. The plate glass facing of the exhibit rises a sheer 35 feet into the air. More than half-way to the top, a balcony spans the show-case horizontally with stairways leading up on either side. This balcony wasn't just thrown in as a sort of architectural baker's dozen when the hall was built. It has a definite purpose. When you've climbed one of the stairways, imagine you are on the deck of a yacht, anchored in warm Bahaman waters, for when you look at the exhibit from this position you see exactly what the artists and craftsmen who conceived the exhibit saw when they stood on a yacht's deck. They wanted you to see this scene in just the same way.

Once "on deck," you look out at the sky, clear blue, with towering trade wind-blown clouds, floating toward the west. And not only the clouds, but each of the landscape's component parts is motivated by the trade wind. You see how it has shaped the topography in an east to west movement as far as the eye can reach. Far out on your left, the deep blue ocean rolls westward, carrying in its wind-directed waves the tiny organisms on which the corals feed. Suddenly, the rolling breakers change to rippling pale green water—they have reached the eastern edge of the submerged barrier reef. Then your eye falls on the tree-studded part of the reef that rises out of the water. Here again you see the formative influence of the trade wind on everything from the palm tree fronds to the preponderantly eastward development of the food-seeking coral reef which has grown out to meet the waves. Above the low scrub trees of the reef a flock of startlingly life-like pink

flamingoes, seemingly borne along on the wind, are flying across the lagoon toward the distant woods of far-flung Andros Island.

When you have seen all you want of the upper section of the exhibit, go down the stairway and you will find yourself, protected by a figurative diving helmet, at the bottom of the sea surrounding the barrier reef. A horizontal plate of glass subtly painted to represent surface water divides the exhibit in half. Beneath it in full detail, the myriad forms of life that surround a submerged coral reef appear in actual proportions. Thirty feet of ocean floor is displayed in living color. Giant elk-horn corals give colorful variety to the scene before you; feathery, trailing gorgonians float upward; and delicately tinted weirdly shaped fishes dart out from the shadowy intervening waters. Coral formations and sponges—yellow, gray, brown, red—have been arranged in the



same position they occupied when the five Bahaman expeditions found them. These formations are made up of forty tons of coral, collected under great hardships and installed in the exhibit under still greater difficulties. For the laws of physics in operation at the bottom of the sea are vastly different from those that hold true in the air. And to place these tremendously heavy bodies in their exact natural position required unprecedented feats of engineering.

Nearby, a companion exhibit is in process of construction—the Pearl Divers' Group based on Doctor Miner's South Sea investigations. When completed this spectacular display will show the sculptured figures of two native pearl divers plying their trade off the small coral island of Tongareva, south of the equator in the mid-Pacific. One of the divers is in the act of cutting away a pearl shell from the floor of the lagoon which is strewn with ten and a half tons of coral collected and brought back to the Museum by the Tongareva Expedition. Scores of beautiful pearl shells each measuring more than eight inches in diameter are scattered about the open spaces between the coral. Although only fourteen feet in height, this group stretches thirty feet horizontally, and in order to produce the effect of an undersea coral canyon, many exacting experiments with the various arrangements of concealed lighting and glass background were necessary.

The Bahaman Coral Group and the Pearl Divers Exhibit are unique, not only as tangible products of the exhaustive scientific research that went into their making, but as examples of the very latest advances in the artistic medium of the exhibition group. The undersea exhibits in the new Hall of Ocean Life are under the supervision of Dr. Roy Waldo Miner, Curator of Living Invertebrates, and without his tireless efforts and those of his departmental assistants, these last mentioned irreplaceables would never have come into existence.

"But," Doctor Miner told your Indoor Explorer, "these groups, like all the other irreplaceables one sees in the Museum, are not placed there simply because they are rarities. The purpose of any exhibit in the Museum, whether it displays something you can see nowhere else or a very common object, is to instruct the public in the lore of natural science. And one can often learn as much from the most prosaic things we have as from our greatest rarities."

—D. R. BARTON.

LETTERS

Sirs:

Information on a subject concerning which many people are misinformed comes from Mr. Henry W. Belknap of Salem, Mass., a member of the American Museum. It is the question of burning witches in Salem, which I mistakenly asserted in the preceding issue of NATURAL HISTORY. As Mr. Belknap points out the current assumption that witches were burned in Salem is not supported by the historical evidence. Although witch burning occurred in England and was fairly common in Germany, it was never practiced in Salem. They hung the victims in New England, and some authorities speak of crushing as a method of execution. The origin of the widespread error presumably arises from European associations. As Mr. Belknap points out, the hanging of witches was bad enough without adding the horror of burning.

HARRY L. SHAPIRO.

New York City.

Sirs:

The matter of renewing membership in the American Museum brings to mind the change that has been made in your magazine during the past year.

For many years, and I may say up to this year, NATURAL HISTORY has appealed to me as one of the best illustrated magazines published in this country—I may say second only to the National Geographic Magazine. However, the change in size and form that was introduced this year has been a very great disappointment to me. The larger size, the garish cover, the run-off illustrations, and other features, apparently added to appeal to the general public, have not appeared to me as consistent with the character of a scientific, or even a popular scientific, magazine.

I fully appreciate the possibility that this magazine would have a better sale on newsstands, and conditions may make it necessary for you to cater to the public

in that way. However, I could not refrain from expressing to you my feeling with regard to the change in form and in character of your magazine.

ELMER S. RIGGS.

Chicago, Ill.

* * *

Lest other readers imagine that NATURAL HISTORY is offered for sale on newsstands, opportunity is taken to state that it is distributed only to members of the American Museum.

One year after its change in format, NATURAL HISTORY solicits other reactions of its readers regarding its size, subject matter and treatment.

THE EDITOR.

SCIENCE IN THE FIELD AND IN THE LABORATORY— *World's Largest Aquaria in Florida—Canoeing through British Columbia's Rapids—Doctor Murphy Honored—New Acquisitions—Members' Lectures*

Oceans in Miniature

Administering a hypodermic injection to a large, very much alive shark is a pastime few readers would care to take up. But anyone planning a Florida trip in February will be missing a unique opportunity if he fails to visit the two largest aquaria ever built, containing live specimens of giant fish that had to be hypodermically drugged before transport from their native haunts. These two aquaria and the world's only specially designed underwater motion picture studio are sponsored by Marine Studios and are nearing completion at Marineland, Florida, eighteen miles south of St. Augustine and thirty-five miles north of Daytona Beach on the new Ocean Shore Boulevard. In these two large tanks known as "Oceans in Miniature," large and small fish and aquatic mammals are presented just as they are found in their natural surroundings, under conditions duplicated nowhere else in the world.

"Our idea," says W. Douglas Burden, trustee of the American Museum of Natural History and President of Marine Studios, "is to build something which is sound and of lasting value, of value to the public, of value to the community in which we are located, and of value to ourselves."

Marine Studios endeavors to duplicate, so far as circumstances allow, conditions existing in the open sea. For example, a coral garden is built right in the tanks. The highly colored coral fish are obliged to seek safety from their enemies just as they normally do in the open sea by escaping in among the interstices of the coral growth where the larger carnivores cannot follow.

Various sea grasses and sea weeds grow from the bottom of the tanks thereby increasing the beauty of the scene and affording protection for certain small forms such as the pipe fish. Jelly fish float near the surface accompanied by their camp followers, the tiny fish that derive safety from their stinging tentacles. Lobsters, an octopus, and perhaps an eleven-foot spider crab, and other bottom feeders can be seen from the lowest row of portholes. Altogether, there are some 8,500 species of aquatic animals.

This enterprise hopes to give the spectator a dramatic and vivid and fascinating cross-section of life in the sea where the struggle for existence takes place in even more violent form perhaps than on land.

The method by which Marine Studios affords its visitors a unique opportunity to study marine life centers around the construction of the tanks themselves. One tank is rectangular, 100 feet long, 40 feet wide and 18 feet deep; the other tank is circular, 75 feet in diameter and 11 feet deep. Enclosed galleries run at different levels around the entire perimeters of the two tanks. Each of the galleries faces inward upon a circle of glass portholes, of which there are over 200 in the sides and

bottoms of the inner tanks where the marine life is displayed.

The portholes are placed in such a way as to make it possible for observers to look into the tanks from four different levels—from the bottom of the tanks looking upward, from the sides at a level just above the bottom of the tanks, from the sides just below the top of the tanks, and from an open gallery around the top of the tanks.

The design of the tanks was recommended by technical motion picture experts who with the greatest care worked out in advance the various camera angles that would be necessary to afford producers the greatest latitude and leeway in the filming of scenes. These angles were the controlling factors that actually determined the shape and dimensions of the tanks and the location of the glass portholes. Everything has been done to assure the value of Marine Studios for undersea motion picture work.

Capturing alive and transporting the larger species which are being placed in these tanks presented certain problems which had to be solved before the project was feasible. Extensive research has developed a method of injecting a drug through a hypodermic needle into the largest sharks, porpoises, giant rays, etc., which puts them to sleep almost instantaneously.

To handle and transport these fish and aquatic mammals a special boat was designed and built in St. Augustine. This boat is constructed entirely of wood and resembles a shrimp boat. Its distinguishing feature is a well in its hull which opens into the sea through a trapdoor.

The well is completely water tight. In its center a metal tank is placed on rollers, so that it can be easily lowered through the trapdoor in the stern of the hull into the water where the fish, under the temporary influence of the anesthetic, is maneuvered into the tank and pulled back into the boat, entirely without injury. On reaching the shore this metal tank is transported by crane and deposited in a flume until the fish has completely regained consciousness, before being placed in the appropriate aquarium. This project is expected to be opened to the public some time in February.

Exploring Early Fur Trade Routes

Mrs. Mary L. Jobe Akeley recently returned to the American Museum of Natural History after a six weeks' expedition in Northern British Columbia. There she followed the old route of David Thompson who first crossed the Northern Canadian Rockies and located the pass near the Columbia Ice Fields, that vast glaciated area between the Athabasca and the Columbia Rivers. On the Big Bend of the Columbia River she reached the historic site of Boat Encampment—today marked only by a clearing in the wilderness. In the early nineteenth century this

remote outpost was the stopping place of the fur traders who journey across the mountains by pack-train from Jasper House on the Athabasca River to the confluence of the Wood River, the Canoe River and the Columbia. There they built their dugout canoes and traveled thence hundreds of miles down the great River of the West to the Pacific. Sometimes they did not return, since for more than two hundred miles along the Big Bend of the Columbia the river is one of the most dangerous in the world. Having both a terrific volume and extraordinarily swift current the river runs in numerous box canyons and perilous rapids.

Twenty years ago, while on botanical and mountaineering expeditions, Mrs. Akeley traveled on foot and by canoe along both the Western and the Eastern spurs of the Big Bend. With Professor Hershel C. Parker, Howard Palmer and Mrs. Albert MacCarthy she went by canoe on both the Columbia and Gold Rivers to Mt. Sir Sanford, the King of Selkirks, then unnamed, where the first attempt to scale the twelve-thousand-foot mountain was made. This year Mrs. Akeley realized a long-deferred dream—to go by canoe through the northernmost rapids of the Columbia. With her pilot Captain McEthern of Golden, British Columbia, an experienced riverman who has navigated the waters of this northern river for a score of years, she made the trip along the very peak of the Big Bend where the mighty river divides the Rockies, the Selkirk Range and the Gold Range. So far as she knows Mrs. Akeley is the first white woman to go through these particular rapids.

Along Wood River Mrs. Akeley found definite traces of very old trails, which she believes are remnants of the original route of the early fur traders. There were also stumps of gigantic cedar trees showing ancient cuttings from which dugout canoes had doubtless been made. This region now affords the last vast area of virgin forest along what will soon be the completed trans-Canada highway connecting Quebec with Vancouver.

On expeditions in Northern British Columbia prior to her marriage to the African explorer-naturalist Carl Akeley, Mrs. Akeley made the first reconnaissance survey map of the headwaters of the Fraser River and a high peak in the Northern Rockies was named Mt. Jobe in her honor by the Geographic Board of Canada.

Brewster Medal to Doctor Murphy

The American Ornithologists Union at its 55th meeting held in Charleston, South Carolina, in November, awarded the Brewster Medal to Dr. Robert Cushman Murphy as a result of the publication by the Museum of his monumental study of the Brewster-Sanford collection of sea birds.

For the second time, the medal founded by the late William Brewster of Cam-

bridge, Massachusetts, has been received by a member of the American Museum's ornithological staff. This coveted honor, which is entrusted to the care and discretion of the American Ornithologists' Union, was won in 1933 by Dr. Frank M. Chapman.

The report of the special committee on recommendations follows:

"For the award of the Brewster Medal the undersigned recommend the work by Robert Cushman Murphy, entitled *Oceanic Birds of South America*, in two volumes, published in 1936, as the most important work relating in whole or in part to the birds of the Western Hemisphere that has appeared during the six-year period between July 1, 1931 and June 30, 1937, this being the time concerned under the stipulations governing the award.

"We have come to this conclusion unanimously after a careful survey of the literature of the period in question.

"ALEXANDER WETMORE, Chairman
(United States National Museum,
Washington, D. C.)

JAMES H. FLEMING, (Toronto, Ontario)

JAMES L. PETERS,
(Museum of Comparative Zoölogy,
Cambridge, Mass.)"

Britisher Praises Museum Birds

In order to call attention to a Bird Group in the American Museum of Natural History that should prove of great interest to the British public, G. Grey Turner, bird-lover and friend of the late Lord Grey, wrote the following letter which was published in the London *Times*:

"Sir,—

"During a few hours spent in New York in transit from train to ocean steamers, I recently made an all too brief pilgrimage to the American Museum of Natural History with the especial object of seeing the collection of birds which has been set up to commemorate the Grey-Roosevelt walk in the New Forest. Those who have read the late Lord Grey's *Twenty-five Years* and his lecture on 'Recreation' in *Falldon Papers* will recall the delightful accounts which the author gives of that occasion.

"The memorial takes the form of a large habitat group, a plan of exhibit which, if I mistake not, was first conceived and carried out by that great north country naturalist John Hancock.

"The present Curator of Ornithology in the Museum, Dr. Frank M. Chapman, who kindly acted as my guide, informed me that together with an artist he traveled to England in May of 1922 and was taken by the late Lord Grey to a characteristic spot in the New Forest on the route of the now famous walk. Here the artist painted a background of sunlit beech trees with hawthorn in the distance and scarcely clouded sky. A small beech tree, a furze bush, some heather, and a selection of typical grasses were also collected, and with these and other materials a wonderful setting for the birds has been created. In this sylvan scene the birds have been distributed as though they were keeping a watchful eye on the large brown owl, which is perched in a prominent position on a branch of the beech.

"Lord Grey himself told me that it was

difficult to decide how the exhibit could be made to explain intuitively the congregation of so many varieties of birds within the limits of a small area, and it is a happy solution to depict them joining forces to keep guard on a natural enemy like the owl.

"The memorial will give great delight to those bird lovers who venerate the memory of our great statesman and his distinguished American friend on what in retrospect may be regarded as an historic occasion. Unhappily, neither was spared to see the finished memorial. The exhibit is very difficult to photograph, and as there is no descriptive leaflet, the visitor cannot carry away from the Museum anything more than a very vivid mental picture.

"I am, Sir, yours faithfully,

G. GREY TURNER,
Huntercombe Manor,
near Taplow, Bucks,
Oct. 20."

New Acquisitions—a Giant Ruby

Late in November of last year the Department of Minerals and Gems received as a gift from Mrs. George B. deLong the most important single gem specimen that has been recorded by it during the last thirty-five years.

This phenomenal gem is a star ruby of one hundred carats weight, with well defined ruby color, and displaying a reflected star of unusual brilliance and definition.

Experts of many decades of experience unite in pronouncing this the largest staruby of any that even remotely approach it in quality and brilliance.

Unlike many of the celebrated oriental stones this star-ruby, which probably originated in Ceylon, has never received a definite name. It has now been named "the Edith Haggard deLong Star."

The upper section of case III in the gem series has been adapted to form a colorful setting display conformable with Mrs. deLong's gift by Mr. William Bayard Okie, the talented designer of gem displays.

1500-Year-Old Mummy Bundle

A completely dessicated Peruvian mummy estimated to be about 1500 years old and swathed in remarkably preserved textiles will be exhibited in Education Hall from January 8 to February 23. Most striking aspect of the exhibit is the mummy wrappings, for the most part in good condition and showing astonishingly beautiful weaving, intricate design, and range of color. The head turban, which was wrapped round and round the mummy's head, measures twenty-one feet in length. There were also ten poncho shirts in various states of preservation, four of which will be on view. Other materials found with the mummy included a feather fan, pieces of gold, peanuts, corn, and chili peppers.

This fine specimen found in Paracas, Peru, was loaned by the Peruvian Government through the Peruvian Ambassador at Washington—the Honorable Manuel Freyre y Santander, who is sponsoring the exhibit, on behalf of General

Oscar R. Benevidas, President of Peru the honorable Ernesto Montagne, Minister of Instruction, and Dr. Julio C. Tello of the University of San Marcos.

Optical Properties of Minerals

A collection of wood and wire models to illustrate the optical properties of crystallized minerals was put on exhibition late in December by the Department of Mineralogy.

Far superior to any similar previously made wire models, these new chromium-plated three-dimensional diagrams are clearly labeled so that the visitor may secure a more tangible conception of the conditions within a biaxial crystal responsible for the peculiar optical properties. A lettered photographic reproduction of one of the models, a single octant of the complete wave front model of a positive biaxial crystal, shows some of the finer features. The models which were made and contributed by Arthur H. Dibbern of Glendale, California, are extremely useful for student instruction in the principles of optical mineralogy.

Less valuable to the student, but of definite interest to the general public are the uniaxial crystal wave front models also shown. They are made of wood, with the outer surface of one octant cut away to show the surface of the inner wave front. Both positive and negative crystals are illustrated in this way.

Indian Watercolors

An exhibit of over two hundred water-color portraits of Indians of the North and Northwest will be on view in Education Hall from January 8 to 23. These were done from life during fifteen summers by Mr. Joe Scheuerle of South Orange, and include pictures of the Sioux, Cheyennes, Crows, Flatheads, Arapahoes, Shoshones, and others. Mr. Scheuerle is a pupil of Mr. H. H. Sharp of Taos, N. Mex.

Planetarium News

"Stars of the Winter Night," is the January presentation of the Hayden Planetarium. A feature of the program is the relation of the ancient Greek Myths told centuries ago about the stars, and repeated in the Planetarium during the January showing. Performances are given daily at 2, 3, 4, and 8:30 p.m. Extra performances are on Saturday at 11 a.m., and on Sundays at 5 p.m.

* * *

The Amateur Astronomer's Association which meets on Wednesday evenings, and the Junior Astronomy Club which meets Saturday evenings announce the following programs for this month:

January 5: *Peruvian Eclipse Experiences—Part II.* Mr. William H. Barton, Jr. and Mr. Charles H. Coles of the Planetarium Staff.

January 8: *Latest Astronomical Discoveries—Dr. E. E. Free.*

January 19: *Modern Seismology—Rev. Joseph Lynch, S. J., Fordham University.*

January 22: *Telescopes and How They Work—Mr. Robert Cox and others from the Optical Division of the A. A. A.*

YOUR NEW BOOKS

CHINESE AND JAPANESE IN AMERICA • SUNSPOTS ON THE STOCK
MARKET • SOD-HOUSE FRONTIER • AUDUBON AT TWELVE-FIFTY
TITANS OF EXPLORATION • JEANS ON MUSIC

AMERICANS IN PROCESS: A Study of our citizens of Oriental Ancestry

- by William Carlson Smith, Ph.D.

Edwards Brothers, Inc., \$3.00

EVERY immigrant minority group in its adjustment to American life is beset by problems and tribulations which become subtler as the process of assimilation reaches more intimate stages of integration. This is one way of saying that every member of a minority group, as long as he is identifiable with it, shares its collective status. For most immigrants of European origin, the rapidity of cultural adjustment depends on the ability or willingness of the individual to adopt American cultural patterns. Whatever success he achieves is not betrayed by noticeable physical differentiation. But where distinctive physical differences are superimposed upon cultural conflicts, the situation becomes tragic for the individual. Such an individual is trapped in a vicious circle. He cannot escape his group which in turn is perpetuated because its various members are forever distinguished by the insignia they bear stamped upon their faces. If the disorganization, the conflicts and the maladjustments of European immigrant groups deserve sympathetic understanding, how much more deserving, then, of our serious study are such groups as the Chinese and Japanese. Their lot is particularly hard. They are eager to become Americans, at least the native born generations display this desire; they have manifested a capacity to absorb our forms of life and education; and they have demonstrated an economic ability to maintain themselves in our society. But they have not succeeded in dissolving their differences in the American brew. Each attempt to attain ultimate identification with Americans and American life is rebuffed because they are involuntarily guilty of the unforgivable social sin of being physically distinctive. The point at which failure occurs, is of course, established by circumstance.

Doctor Smith in his book deals with the sociological situation of these oriental Americans, in process. To clarify the present status of the Chinese and the Japanese and the factors which have produced it, he makes use of the admirable contrast between conditions in Hawaii and those on the West Coast. Much of his interpretation is drawn from numerous "life histories."

Sociologists have observed that minority

groups are subjected to oppressive measures in proportion as they become obtrusive. Here the situation is reversed. The orientals are relatively far more numerous in Hawaii than on the West Coast but the prejudice against them in Hawaii is milder than on the mainland. Partly, this may be explained by reason of the favorable conditions created by Hawaiian traditions of racial tolerance. Doctor Smith analyzes the respective conditions in Hawaii and on the West Coast from the point of view of numbers, economic competition and adjustments, the struggle for recognition and status. He discusses the role of the church, the school and language in the Americanization process, and he describes the disorganization and the acculturations evident among the native born Chinese and Japanese. This is a study of extraordinary interest and should contribute largely to the understanding of the anomalous position in

which the native-born Chinese and Japanese find themselves. One cannot, however, help feeling a certain reservation in accepting all the generalizations which Doctor Smith presents. The adequacy of the sample is nowhere demonstrated. One must trust Doctor Smith's insight, since he obviously cannot reprint all his "life histories." This reader, at least, kept asking himself how reliable a "life history" might be when written by the subject himself. "Life histories" are revelations of attitudes which may or may not be based on fact, a distinction which is not especially clear in Doctor Smith's presentation.

Perhaps it is asking too much of sociology to conform to standards not yet possible. It deals with an incredibly complex phenomenon which defies objective methods.

H. L. SHAPIRO.

SUNSPOTS AND THEIR EFFECTS

— by Harlan True Stetson
Whittlesey House, \$2.00

"WHAT, then, are sunspots? Terrible storm centers on the sun, cyclones, hurricanes, often covering billions of square miles and dwarfing to insignificance the most violent tropical hurricane, or the worst China Sea typhoon, that has ever happened in the world's history."

This is from the recent work by Doctor Stetson (Research Associate of the Massachusetts Institute of Technology). The book is a popular description of the many and various relations between sunspots and animal and plant life, together with the meteorological and magnetic effects which the sun's activity has on our globe. It is a timely discussion, for we are coming to a sunspot maximum, when many such effects may be made manifest.

In the first part it is shown statistically how stock-market activity has followed sunspot numbers in regular cycles. Then follows an outline of the correlation between solar variations and human behavior. It speaks of mass movements of peoples, effects of ultra-violet radiation, ionization of the atmosphere, ductless glands. Growth of trees, vintages of wine, and fur coats of animals are also found to be correlated with sunspot maxima and minima. The bearing of sunspots and radio* reception at different wave lengths has a chapter to itself. In the section on

*Three years ago the same author wrote an excellent and comprehensive book, *Earth, Radio & Stars* in which this subject is discussed more exhaustively.

A Scientific Book Club Selection
"A truly thrilling account

THE ADVANCING FRONT of SCIENCE

By George W. Gray

"There is today available to the general reader a broad perspective of science that was denied to all but the most fortunate and persistent of graduate students twenty years ago. And *The Advancing Front of Science* by George W. Gray is one of the very good reasons why that is true. Mr. Gray writes with intelligence and skill, never becoming dull, yet never palming off any of the jazzy caricatures which so often pass for popular science. Incidentally, a whale of a lot of things have happened in science in the past two decades. I marvel at the industry and versatility of the man in gathering so much material, direct from the men who are creating the science of today." —Paul B. Seers, author of *Deserts On the March*

SECOND LARGE PRINTING, \$3.00

WHITTLESEY HOUSE
McGraw-Hill Book Co., N. Y.

business activity Doctor Stetson shows how manufacturers, automobiles, and building contracts follow sunspot activity, but crops do not.

A large chapter is taken up with the types of radiation of sunlight according to different wave lengths. Under the subject of sunspots and weather he discusses correlation of sunspot cycles with weather conditions and the possibility of climate forecasts based on the long observations of Doctor Abbott.

Comparison of prodigious energy of the sun with our power plants is brought out in such passages as the following: "Suppose we had to pay for the light from the sun for an average twelve-hour day of daylight. The bill for but a single day would amount to 30 million million dollars even at the very low rate of two cents per kilowatt-hour. . . . The cost of sunshine for Greater New York for just one day would amount to 100 million dollars."

HUGH S. RICE.

THE SOD-HOUSE FRONTIER, 1854-1890: A Social History of the Northern Plains from the Creation of Kansas and Nebraska to the Admission of the Dakotas.

----- by Everett Dick, Ph.D.
D. Appleton-Century Company, \$5.00

OUR national history is best interpreted as a narrative of the westward advance of the frontier, tumbling over the Appalachians when Washington was President, reaching the Mississippi about 1830, then rolling into the Great West after the Mexican War.

If you wish to know what the frontier was like when it reached the Missouri River, when within a few months 12,000 homesteaders were ferried across that muddy stream, going forward to locate upon a patch of land in an endless waste of grass, to live in a sod-house because there was nothing else to build it of, to see human nature at its worst and again at its best, to understand what men and women can endure and at last achieve, then here is the book for you. The author is an historian, careful to sift his facts, stating in simple language just what happened when Kansas, Nebraska and South Dakota were young, not trying to be thrilling, but letting the matter of fact narratives gradually grip your emotions. You will be stirred by the desperate struggles of the homesteaders against drought, dust-storms and grasshoppers, the masterly descriptions of which make recent events in the "dust-bowl" seem commonplace. As the reader turns the pages of the book he will come to understand the origin of such terms as "homesteader, hayseed, land-shark, clod-hopper, sorghum-lapper, claim-jumper and land-office-business," yes, and he will feel their dynamic symbolic power. The booster, the promoter and the land speculator are shown up without mercy; how they sought to suppress news of crop failures and other disasters for fear they would check the tide of home seekers from the east.

Even when the Indians perpetrated an organized massacre on a wide front, these interests did their best to conceal the facts and prevent demands for military action. But more important are the chapters on family life, the school, the church, going to town, makeshift industries, the doctor and death. And one cannot overlook the excellent sketches of every kind of faker, from patent medicine salesmen and fruit tree peddlers to full-fledged bandits. Incidentally, the long and by no means bloodless struggle between the cattlemen and the homesteaders during the period when Theodore Roosevelt tried his hand at ranching is adequately treated. Finally, we cannot neglect to mention a good account of the evolution of farm machinery, a development which received its greatest impetus among the homesteaders when the 1000-acre farm became commonplace. Contemporary photographs add to the reliability and liveliness of this record.

CLARK WISSLER.

THE BIRDS OF AMERICA.
(Audubon) With an Introduction and Descriptive Text

----- by William Vogt
Macmillan Company, \$12.50

IN NATURAL HISTORY for March, 1937, the bird portraiture of John James Audubon was compared with that of Louis Agassiz Fuertes. Each was admittedly the greatest bird artist of his day but Fuertes was considered the greater—an estimate generally accepted.

There is no new matter contained in the volume under review. Comment on Audubon's work should be based on his presentation of it in the Elephant Folios or, better still, on his originals, and we are here concerned, therefore, only with the Macmillan Company's degree of success in placing in one reasonably priced volume reproductions of all Audubon's published drawings of birds.

Of the 500 plates thus presented 435 are from the Elephant Folios and are reduced to about one-third the size of the originals. The remaining 65 are from the seven volume octavo edition of his greater work which he issued in 1840 after his return from England. They represent species, mostly from the west, with which Audubon was not familiar at the time his earlier work was completed. All are here reproduced by a photographic process that ensures accuracy of line and form but not always of color. The owner of this volume may therefore be assured that he possesses a faithful rendering of Audubon's drawings but he must not accept too literally the colors in which they are shown.

However, one should not be over critical of the results obtained in so great an undertaking where mass production, rather than a limited edition, was the end in view. In most instances the departure from the original offends only the eye of the expert. In comparatively few is it so wide as to be at once obvious to the untrained eye. In fewer still, the bird figured is unidentifiable and then it is usually Audubon, rather than the engraver, who is at fault.

But, on the whole, we ~~more~~ ^{more} ~~especially~~ ^{especially} welcome this volume as a means of making Audubon, the artist, known to those to whom he has heretofore been ~~an~~ ^{an} name or a society. Our congratulations, therefore, go to the Macmillan Company as sponsors of a great ornithological enterprise.

Let us hope that their success will induce them to follow this reproduction of Audubon's plates with a reprint of his five great volumes of ornithological biographies. It is on these, rather than on his paintings, that his standing as an ornithologist rests. In practice, his paintings have long been superceded by others that more accurately meet the needs of the student, but his text will always hold its place as a contribution to the history of the species with which he was familiar and as a graphic record of the bird-life of his day.

The text in the present volume is by William Vogt, editor of *Bird Lore*. He supplies an introduction and a three or four line caption beneath each plate which contains authoritative information concerning the range, habitat, characteristic markings, voice, food and nesting of the species figured.

F. M. C.

SCIENCE AND MUSIC

----- by Sir James Jeans
Macmillan Company, \$2.75

SIR JAMES JEANS' new book, *Science and Music*, is in line with the growing tendency for the general reader to study science and nature not as a dilettante but as a man trying to discover the relation of phenomena to his own life. Sir James packs as much information as possible in the smallest amount of space. His book will appeal to the objectively-minded musician—whether producer or consumer. It will not appeal to the person who seeks in music only its emotional impact; there are no passages describing the agony of sadness in the cellos or lone flights in the empyrean on the piccolo.

The work begins with the evolution of the ear from the "lateral-line" organ of the fish, includes a concise exposition of the modern treatment of acoustics by absorption units illustrated with the dissection of actual problems, and ends with the unbelievably complex structure of the human cochlea with its twenty-four thousand minute fibers.

But the main body of the book is devoted to explaining how sound develops and reaches the human brain. Sir James first describes pure tones then the cause and behavior of harmonics. With this background he analyzes the structure and functioning of all the important musical scales from the pentatonic to the present equal-temperament version. Continuing his reasoning, he speculates on new scales which are possible in the future. His thesis is that when technology allows music to be made by machine instead of by man, scales may be used which cannot be employed now because of physical limitations.

JOHN N. CARLEY.

SWIFT MOVEMENTS IN THE TREES (AND AT THEIR ROOTS)

----- by Phyllis Kelway
Longmans, Green and Co., \$2.50

IN the field of natural history there is a great need for facts about the everyday life and habits of wild creatures. We have quantities of literature on why this and that belong to a certain genera or species, and what constitutes a family or an order, but all too little that adds to the knowledge about the domestic doings of the common "wild folk." This new book with the rather awkward title, *Swift Movements in The Trees (And At Their Roots)*, adds many interesting items to the latter form of record.

Phyllis Kelway belongs to the not too plentiful group of people who spend hours watching members of the animal world and recording their activities in book form. In this new book she has made available in a very pleasing English manner some of her observations on the habits of the red and grey (sic) squirrels, shrews, moorhen, and the common toad, accompanied by photographs of each.

The setting is England, and her subjects European forms, except for one American mammal, the gray squirrel. This species was, I fear, an all too unwelcome introduction into the British Isles. On July 31, 1937, the gray squirrel was designated an outlaw by Scotland and ordered destroyed. Of this intruder Miss Kelway writes:

"The Grey is destructive; he may be ruinously destructive but for one oft-repeated crime I do not think he is to blame. No one will agree, I suppose, that the Grey is not responsible for the banishment of the Red from the districts where the Red have hitherto been common."

The European red squirrel, which has somewhat different habits from our form, seems to be one of the most beloved of the British mammals. Hence an intruder from another continent, such as our gray squirrel, that drives out one of their indigenous forms is not a very welcome guest. The chapter on this transplanted interloper gives a new slant on the life of one of our common and much liked squirrels.

A number of the animals about which Miss Kelway writes have been her pets, and she has reared them in habitats as nearly like their wild state as possible. Because they were somewhat restricted in their wanderings she has been able to watch activities that are not often observed—the red squirrel's method of rolling up straw into bunches and carrying it under the chin when taking it in to line the nest, the bloodthirstiness of the shrew at mating time, and the shedding of the "sealing-wax" seal from the top of the bill by the moorhen chick.

The stories are well told and will no doubt be enjoyed by older children and adults who are interested in prying into the private lives of these Europeans whose counterparts are found in America.

FARIDA A. WILEY.

ASCARIS: THE BIOLOGIST'S STORY OF LIFE

----- by Richard Goldschmidt
Prentice-Hall, Inc., \$3.25

DR. RICHARD GOLDSCHMIDT, the noted geneticist of the University of California, has given us a unique presentation of life processes. The humble, but sometimes annoying, parasitic roundworm, *Ascaris*, serves as our guide in a rapid and tabloid survey of animal physiology and behavior. Doctor Goldschmidt treats of life in a comparative fashion under such headings as, "The Skin," "Body Fluids," "Nervous System" and "Development." Throughout these complexities of anatomy and physiology the simple *Ascaris* serves as the point of departure. The story moves along in sprightly fashion, now discussing the ear of vertebrates and then the organs of equilibrium of a jellyfish. In spite of occasional conversational vagaries the central theme, *Ascaris*, pops up in time to draw one back on the track.

The chatty style is indeed refreshing and will probably be enjoyable to the lay reader. It is made especially entertaining by the author's many personal experiences, gained while teaching at the University of Tokyo and as Director of the Kaiser Wilhelm Institute.

"Once when hiking through the peninsula of Istria, after a strenuous day, tired and hungry, we came to a native village inn. There was only one room, and the center was occupied by a kind of open fireplace surrounded by benches. In a huge kettle, hanging from the ceiling, polenta was prepared, of which the guests partook, helping themselves silently from the central kettle. This method of serving may be used as a comparison with the most primitive method of feeding the cells of the body with the products of intestinal digestion." Thus the author suggests the way in which the Coelenterates absorb their food.

The chapter on heredity and its mechanism is particularly lucid, but there are none of the pleasant diversions which heighten the readability of most of the book. The geneticist is foremost here and the presentation is that of an elementary text-book.

Taken as a whole the book should appeal to anyone with even a mild interest in biology. Any errors, such as the author's statement that snakes hear, are detailed and are hardly worthy of exception in so popular a presentation. Professor Goldschmidt's active participation in biological research is reflected in the up-to-date material included in the book, and his scholar's urge to motivate enlightenment of the laity is summed up on his last page as follows: ". . . behind every point which we have discussed stands a mountain of known facts, of solved and unsolved problems, accessible only to trained mountaineers. But why not acquire this training? . . . There is no knowledge which cannot be mastered by patient work."

G. MILES CONRAD.

DAYLIGHT MOON

----- by Elizabeth Chabot Forrest
Frederick A. Stokes, \$3.50

A YOUNG married couple, realizing the hopelessness of Oregon dry-farming, accept a position as school teachers at Wainwright, Alaska—a small Eskimo village on the Arctic Coast a short distance southwest of Point Barrow. When the Forrests arrive at their new home in the north, they soon discover that their task is not confined to the classroom. The little schoolhouse which provided their living quarters was also the hospital, the court house, the post office, the store, and the house of worship for the natives. These young people became not just teachers, but the sole medical, economic, moral and spiritual advisors for the village.

In *Daylight Moon* Mrs. Forrest tells the delightful story of their varied experiences during their three-year stay with the Wainwright Eskimos. They grew fond of their work, began to see the results of their efforts, and felt that the arrival of their "Little-White-Owl" would enable them to stay, but ironically enough it was the ill health of their young son which caused them to leave unfinished what they had begun. The story is written from and for a woman's point of view, and in an acceptable style which possesses the frankness that often characterizes writings of the North.

ERICH M. SCHLAIKJER.

EXPLORING THE HEAVENS

----- by Clyde Fisher
Thomas Y. Crowell Company, \$2.50

DOCTOR FISHER'S experience in presenting the various subjects of astronomy to the general public in a non-technical way qualifies him peculiarly for the writing of this book "for the nature lover not mathematically inclined but keenly interested in the starry sky." The clear and accurate descriptions throughout the book, which anyone can read with understanding and pleasure, well justify his thesis that much of the beauty and interest of the heavens can be appreciated without reference to mathematics.

The first part of the book treats of the earth's more immediate celestial neighbors—the sun, moon, planets, comets and meteors. Particularly interesting in this part are Doctor Fisher's impressions of the meteor craters in Arizona and Estonia, which he has studied, and of eclipses of the sun, which he viewed from Siberia, Peru, and elsewhere. The second part describes the constellations in their seasons and then introduces a variety of subjects, such as telescopes and the polar aurora. "A Glimpse of Relativity" includes the author's own photograph of Doctor Einstein. Finally, there is a brief account of the Hayden Planetarium, which in the first three months after the opening of its doors to the public, on October 3, 1935, was visited by 300,000 people.

Many illustrations contribute to the excellent appearance of the book; they range from woodcuts of celestial sights of long ago to recent photographs with large telescopes. A number of photographs of observatories and meteor craters were taken by Doctor Fisher himself and by the gifted Te Ata, to whom the book is dedicated.

The growth of public interest in astronomy in recent years is doubtless due in large measure to the increasingly numerous and attractive means of presenting the subject, of which the planetariums are examples. Well-written and authoritative books about the heavens for the general reader have shared in promoting this interest. Doctor Fisher's excellent book is a welcome addition to the list.

ROBERT H. BAKER,
Professor of Astronomy,
University of Illinois.

MAP MAKERS

----- by Joseph Cottler
and Haym Jaffe

Little, Brown and Co., \$1.75.

IN the history of civilization there is nothing more inspiring than man's gradually increasing knowledge of the earth on which he lives. This story of exploration has been told many times and from many points of view, but it is so varied and so rich in incident that any new book is worth while that is in any way more than a simple rehash of those already available. The present book is not particularly well written or original but it, too, has virtues that can be recommended with certain reservations.

The history of exploration as here told is organized around the lives of some twenty-five outstanding explorers, from Herodotus to Roy Chapman Andrews, who, with William Beebe, is the only living explorer included. Each figure represents some different phase of the development of geographic science, and some suggestion of the broader import of these phases is introduced in most cases. This "great man" method tends somewhat to obscure the orderly and social development of the subject and to make it appear rather as a series of isolated and single-handed exploits. For instance, a chapter is devoted to the subject of paleontology with hardly a mention of the name or, explicitly, of the work of a single paleontologist because, despite all that Doctor Andrews himself has said, and despite his outstanding and open record, he is selected as the great man of this science rather than as the great organizer and initiator of modern cooperative exploration that he really is.

This approach does, however, make for interest in younger readers who are most easily attracted by personality and daring. The names selected are all admirable and deserving of this distinction, and some are even peculiarly apt and rather unusual in such a summary. Marco Polo, Columbus, Livingston, Amundsen, and others are inevitable, but

it is admirable to find also a few names of men equally illustrious but less publicized, such as Humboldt, Rawlinson, and Milne.

The subject is enlivened by the constant use of imaginary or at best hypothetical conversations and minor incidents, again a device properly calculated to appeal to the juvenile imagination but again one full of pitfalls that have not always been successfully avoided. Principal among these pitfalls is the fact that the introduction of picturesque details requires more intensive knowledge than is here displayed. The result is the inclusion of many minor errors or misleading statements. To mention only three of these—they appear in every chapter—it is not true that Marco Polo "picked up the many languages of the [Mongolian] empire," nor that the bite of the tssetse fly is "harmless to wild animals and man" (nor for that matter that it is "certain death to the ox, horse, and dog"), nor that anyone has ever found remains of a small animal that "had five toes on each leg, but except for that, was a perfect minia-

ture of a horse."

Such details do not, perhaps, falsify the general outline of the work in any important way but they defeat their own purpose, which presumably is to give verisimilitude, and they rob the book of what would be its most important ingredient, the flavor of authenticity.

G. G. SIMPSON.

CATS AND CATS

----- by Frances E. Clarke
Macmillan Co., \$2.50.

THAT all cats are not alike is clear even to one who has never read *Cats and Cats*, a charming collection of stories, anecdotes, and essays from the pens of some of our most popular modern writers. But you are impressed with this fact as you recall the different cats introduced in this volume. Every one boasts an independent character, and as is indicated in several of those stories which deal with the comparison of cats and dogs, perhaps it is this very point which makes them less endearing to the human race. You cannot train a cat to suit your taste as you can a dog. She, or he as the case may be, has a mind of her own, and will react only when and if she sees fit. No more can you demand and get affection from a feline such as you can from a dog, another characteristic which has developed the idea in most people's minds that cats are selfish and lack the capacity for human companionship. Unlike the dog's unquestioning devotion, the cat is capable of an impious type of friendship—if it is accorded the proper appreciation of its own likes and dislikes. She won't kowtow to your moods or take lightly any blows you see fit to bestow. She has her own ideas and expects just recognition of them.

Cats and Cats is not concerned with tales of heroism and self-sacrifice. But one or two which might possibly fit into this category are so poignant you won't forget them for a long time. There is, to

mention only one, "The Totem of Armadillo," the story of a cat who gave his life in defense of a little blind Indian boy.

Since it is a compendium of the work of cat-lovers, most of whom are first-rate professional authors, the book is exceedingly well written. You will find within its pages stories of intelligent understanding that will decidedly change your mind about cats, if you are one who has thought little of them before. And for those who have known the particular friendship of this animal, here is a book to provide you with enjoyable evenings for a long time. You'll want to re-read many of them.

B. G.

WAYS OF BIRDS

----- by Thora Stowell
Design of Life Series. No. 2
Chas. Scribner's Sons. \$2.00

THE author discusses, for younger readers, many of the interesting habits of birds and something of their anatomy and physiology. Particular attention is given to English species, but many foreign birds are treated with general or special references, often from personal experiences of the author in certain regions far afield.

The accounts of direct observations on the habits of species with which the author is acquainted appear to be accurate, but when the field widens beyond these limits there are numerous inaccuracies and misstatements which discredit the text as a reliable exposition of fact. Some of these statements may possibly be applicable to the English species of the groups under discussion but not to all the members of such groups, and there is no indication that such restriction is intended. Other statements may have elements of truth in them but are just beyond the strict limits of fact. Some may be due to no more than careless writing or careless proof-reading.

Such is the statement that penguins fill their lungs with water before diving. The Secretary Bird is said to be from South America, when South Africa should have been stated. Ostriches are still credited with hiding their heads in the sand and the reason given is that the birds realize that this is their most vulnerable part because of the very weak structure of the skull. Feathers are said to be produced in minute moulds in the skin which are perfect models of what is going to be. Nerves of touch are said to be present only in the Woodcock and Hoopoe. Food is said to pass in a liquid state directly from the gizzard into the blood. And other notes of similar misinformation are scattered through the volume.

The author calls attention to the existence of numerous museums of natural history where information about birds is made available to the interested student. It is unfortunate that the manuscript of the present book was not critically examined by a competent ornithologist in some such institution, or elsewhere, before being presented to the public.

J. T. Z.

Calendar of January Lectures

January 8

2:00 P. M. Free Motion Picture on THE LIFE OF LOUIS PASTEUR

January 11

8:15 P. M. Know Your Museum Meeting for Members: THE ORIGIN AND EVOLUTION OF MAMMALS

January 15

2:00 P. M. Free Motion Picture on ALEXANDER HAMILTON

3:30 P. M. Lecture to Adult Students' Association: THE STORY OF WRITING, by Marguerite Newgarden

January 22

2:00 P. M. Free Motion Picture on INKA LÄNTÄ IN ARCTIC LAPLAND

January 25

8:15 P. M. Know Your Museum Meeting for Members: THE ORIGIN AND EVOLUTION OF THE PRIMATES

January 27

2:00 P. M. Free Motion Picture on ADVENTURES NEAR THE SOUTH POLE

January 28

9:30 A. M. Motion Picture for Washington Irving High School on THE LIFE OF LOUIS PASTEUR

Calendar of Museum Radio Broadcasts

January 1

12:15 P. M. THIS WONDERFUL WORLD (Mutual Broadcasting System—WOR): Question and Answer program by Museum visitors, broadcast from Museum foyer

January 3

2:45 P. M. TODAY'S NATURAL HISTORY, by Robert R. Coles: Radio Talk over WNYC

6:15 P. M. NEW HORIZONS SERIES (Columbia Broadcasting System, Coast to Coast Network): DESCENDANTS OF THE

MUTINEERS OF THE BOUNTY, by Dr. Harry L. Shapiro

January 5

3:45 P. M. MUSIC OF THE SPHERES, presented for the Hayden Planetarium, by Marian Lockwood (Intercity Broadcasting Company, WQXR)

January 6

11:30 A. M. MUSEUM REPORTER: CRICKETS FOR LUCK, by John R. Saunders: Radio Talk over WHN

January 8

12:15 P. M. THIS WONDERFUL WORLD (Mutual Broadcasting System—WOR): Question and Answer program by Museum visitors, broadcast from Museum foyer

January 10

2:45 P. M. TODAY'S NATURAL HISTORY, by Robert R. Coles: Radio Talk over WNYC

6:15 P. M. NEW HORIZONS SERIES (Columbia Broadcasting System, Coast to Coast Network): 1937 PARADE OF THE STARS, by Dr. Harlan T. Stetson

January 12

3:45 P. M. MUSIC OF THE SPHERES, presented for the Hayden Planetarium, by Marian Lockwood (Intercity Broadcasting Company, WQXR)

January 13

11:30 A. M. MUSEUM REPORTER: THE BIG TREE'S STORY, by John R. Saunders: Radio Talk over WHN

January 15

12:15 P. M. THIS WONDERFUL WORLD (Mutual Broadcasting System—WOR): Question and answer program by Museum visitors, broadcast from Museum foyer

January 17

2:45 P. M. TODAY'S NATURAL HISTORY, by Robert R. Coles: Radio Talk over WNYC

6:15 P. M. NEW HORIZONS SERIES (Columbia Broadcasting System, Coast to Coast Network): EXPERIENCES WITH MONGOLIAN BANOTS, by Dr. James L. Clark

January 19

3:45 P. M. MUSIC OF THE SPHERES, presented for the Hayden Planetarium by Marian Lockwood (Intercity Broadcasting Company, WQXR)

January 20

11:30 A. M. MUSEUM REPORTER: DRUM TALK, by John R. Saunders: Radio Talk over WHN

January 22

12:15 P. M. THIS WONDERFUL WORLD (Mutual Broadcasting System—WOR): Question and Answer program, by Museum visitors, broadcast from Museum foyer

January 24

2:45 P. M. TODAY'S NATURAL HISTORY, by Robert R. Coles: Radio Talk over WNYC

6:15 P. M. NEW HORIZONS SERIES (Columbia Broadcasting System, Coast to Coast Network): HIDDEN HISTORY, by Dr. George C. Vaillant

January 26

3:45 P. M. MUSIC OF THE SPHERES, presented for the Hayden Planetarium, by Marian Lockwood (Intercity Broadcasting Company, WQXR)

January 27

11:30 A. M. MUSEUM REPORTER: THE SUN DANCE, by John R. Saunders: Radio Talk over WHN

January 31

2:45 P. M. TODAY'S NATURAL HISTORY, by Robert R. Coles: Radio Talk over WNYC

6:15 P. M. NEW HORIZONS SERIES (Columbia Broadcasting System, Coast to Coast Network): GIGANTIC AND QUEER MEMBERS OF THE INSECT WORLD, by Dr. C. H. Curran

HERBS AND SIMPLES—JUNGLE STYLE

Continued from page 33

and illness serious enough to deserve their consideration gets its full share of highly formalized, ritualistic magic along with its more tangible treatment.

But, as I review all that I have ever seen of jungle *materia medica* and its shadowy practices, there returns again and again to my mind the picture of what seems to me to be the chief sufferer in the world of Amazonian magic and medicine. It is not the patient but, as in our own modern science, it is the lowly and ubiquitous

guinea pig. Aside from his edible value (and, from the Andes down to the Amazon, roasted *cui* is highly valued) he forms an important part of both the magic and the medicine. He is sacrificed in the different religious, medical, and warfare ceremonies, and he nobly gives up his life in the advance of jungle science.

He runs the gamut of martyrdom from tallow to talisman; he serves the jungle man from oath-taking to operations, from provender to poultice. As a nourishing broth, as a roasted tidbit, he is delicious; in the form of tallow he is efficacious; when used as a poultice (simply eviscerated and spread out over the injured sur-

face) he is amply fulfilling one of his manifold ultimate destinies; and, when several of him are stuffed into the bed of the patient as a sort of living hot water bottle, until they smother, he is probably lots of fun and quite a bit of comfort if you happen to be a sick Indian.

Indeed his practicability in my mind is really questionable only when he is used as a sacrifice in certain consecratory and oath-taking rituals—his small bleeding body grasped in the dark and sinewy hand of an Amazonian witchman. And even then I suddenly remember it isn't always wise to question the jungle too closely.

At the close of a successful summer, preparations were made to continue the work on the large island of Chiloé, near Puerto Montt on the west coast. The bulk of our equipment was shipped there by steamer while we were to go in the truck by way of the Atlantic Coast as far as Comodoro Rivadavia, then cross to Puerto Aysen on the Pacific side and continue by boat. Although we did not have a permit to collect or excavate in Argentine territory we wanted to examine a number of private collections which have been made there, and to see some cave paintings near San Julian.

Just before leaving Chilean territory we stopped to look at a cave which we had heard of but had not been able to visit before. Known locally as the Pali Aike Cave, it is near the top of an old volcanic crater ridge but is easily accessible. The interior looked promising: a dry dusty floor about 45 feet long by 25 wide with plenty of headroom. When, after a few days' digging, it became apparent that we had a deposit dating from at least twice as far back as anything we had found previously, our feelings were a curious mixture of pleasure and despair. Without our regular equipment and with only a few days' supplies left, it was impossible to stay longer.

According to the good friend who had been our guide it was questionable how long the track back to Magallanes would be passable. With one assistant it would take at least five weeks to finish the job. More assistants would be impossible without incurring prohibitive expenses. The fine dry dust made the use of masks imperative; a sifter and a wheel barrow would be needed. These and other thoughts came to spoil our pleasure. Moreover we had not even reached the bottom and there was no telling what might be there. Without the record contained in the dust of this old cave our work would be incomplete. It had to be done, somehow.

It was a sad moment when we finally left to continue on through the Argentine, having decided to take a chance on being able to return in the spring. If we had only known how well it would all turn out in the end, how much happier should we have felt.

Auto travel on the Patagonian pampas in winter promises uncertainties and seems to keep those promises. Thanks to the help of the good people along the way we finally made Puerto Aysen, arriving with an intimate knowledge of every other bog hole along many miles of track, as well as a thorough understanding of the value of fencing wire for repairs. No car had crossed the mountains for two months; none other than the old Model T with its high clearance and light weight could have done it.

The coming of spring brought word that the mountain pass was open once more. With dry roads the run south was a contradiction of our previous experience. With a goal in mind the stretches across the high plateaus did seem longer, but Pali Aike hill and cave were still there, just as we had left them.

To give a new assistant training, a

smaller cave some twenty odd miles to the west was cleared first. The results were meager. Nearby, beneath the wall of the canyon through which the Rio Chico flows, a place was pointed out where arrow points and flakes lay on the surface. It promised little more than pure exercise, for many tons of stones had piled up against the base of the cliff. The inward slope of the rock suggested a cave but it was choked almost to the top. A little digging showed that it did go on in and that we could work without moving a yard of stone for every foot of dirt.

As barrow after barrow load of dirt and broken bones rattled down the sifter the little things which, added together, tell their story were picked out and laid aside.

The final chapter in the life of the natives was missing, there being no bones of the domestic horse, copper ornaments, trade beads, iron and other signs of contact with whites. Instead there were the finely made, small arrow points of the Ona tribe, known previously only as inhabitants of Tierra del Fuego south of the Straits. With them, a coarser type of arrowpoint proved the presence of another tribe who, though living here the same time as the Onas, had also preceded them.

Then still further down our digging discloses a third type of point used perhaps on spears, perhaps on arrows. It is the type that had always marked the bottom during the previous season's work, but in this deepening pit it disappears while the camp refuse still continues. A single spearpoint of bone among the usual assortment of scrapers, without a single point of stone, confronts us with a puzzle, and then we are down to what seems to be the bottom. A jumble of lumps and slabs of sandstone cover the floor of the cave; there is nothing to suggest that we should dig further, except one of the simple rules of archaeology which is to dig beyond what seems to be the bottom.

Beneath the sandstone we discover still more bones and among them a type of stone spearpoint new to us. That is gratifying enough, but when we see that the bones are those of horses there comes a most disconcerting feeling.

The domestic horse did not exist in the Americas before the Spanish came, and if these bones should prove to belong to an animal introduced by Europeans, all our conclusions on our previous work were wrong. Though I was willing to swear that 400 years was all too short a time to account for all the material we had uncovered, those horse bones gave us momentarily something of a shock. The only alternative was that they belonged to a prehistoric relative of the common horse. This ancient horse was known to live in South America in times long past, but so far as I knew no one had proved that it still existed when even the earliest people lived here. Without special training in paleontology it was not for me to identify these bones, but it was apparent that they were of smaller, stockier animals than those used in Patagonia today. Later examination proved that we had found the first evidence that this ancient horse was hunted and eaten by the early natives of South America.

Further clearing exposed fire pits from which many fragments of burned and

charred bones were taken. In one of these was a handful of small bone pellets about the size of peas which could have come from only one animal, the ground sloth.

These pellets are an anatomical oddity, though they had been found in various parts of Argentine in association with fossil sloth remains their exact function remained a mystery until the discovery was made in a huge dry cave about 100 miles west of where we were working of a piece of skin in which were embedded many of these bone nodules. It was then known that they were a sort of "armor" inside the skin. The fragment found was well preserved and bore bristle-like hairs. With it were the bones and mummified remains of the sloth and a considerable quantity of manure.

This find aroused worldwide attention, and from the fresh appearance of the skin the story started that the animals could still be found in the recesses of the then unexplored mountain forests. A London newspaper even sent out an expedition to capture or kill one. From the presence of some dry grass in the cave it was claimed that the Indians had domesticated the animals and stabled them there; but the evidence does not support this inference. No modern man has ever seen a living ground sloth; and it is quite unlikely that the ancient Indians domesticated it. But our discoveries proved that the animal roamed the country at the same time that some of the ancient natives did.

When we had finished the work at Fell's Cave, for we have named it after the Fell family who own the land and led us to the spot, we had a fairly clear picture of what had happened there. An eddy of the river had undercut the sandstone and formed the cave at a time when the water was about 19 feet above its present level. A floor of sand and clay had been built up and was still new and clean when the people decided that it would make a good home. It had not been used long when a section of the ceiling collapsed. That this happened while it was actually occupied is suggested by articulated sections of a horse skeleton directly beneath the stones, a leg and shoulder at one place, a head and neck at another, and by the perfect tools and weapons on the same level.

For some years after that no one stayed there. With the passing of time, nature began to smooth and level the floor, so again people began to stop there. In the interval the first group or tribe had disappeared together with the horses and sloths. The newcomers had different weapons and lived mainly on foxes and birds. From the work at Pali Aike Cave we learned that their spears were tipped with bone.

The arrival of a third group is suggested by a change from bone points to a new kind made from stone and by the appearance of bolas, a very effective weapon made of a set of two or three stone balls joined by thongs and hurled at birds and larger game. With this the people hunted geese, rheas, and guanaco, an animal of the camel family related to the llama. These had been common in the early days but became rare at the time the horse and sloth were exterminated.

Continued on page 79

THE GIRAFFE AND HIS LIVING ANCESTOR

Continued from page 50

to answer. It would seem possible, however, that early in the history of the giraffe family the okapi became isolated in a continuously primitive environment, in deep, gloomy forests where he lived on as a quiet, unassuming animal while his more ambitious cousins were evolving strange horns or long legs on the bright plain and the desert. Perhaps the okapi was wise, after all, in being the backward member of his family, for certainly he persisted through the ages, whereas all of his relatives except one, the modern giraffe, sooner or later succumbed during the severe struggle for existence.

For many millions of years the okapi tribe lived in the quiet darkness of the primitive tropical forests, secluded and protected from the harsher environments where evolutionary development was

necessary to avoid extinction. Only at a late date in the history of this animal was he discovered by Man, and then it was the wily pigmy who pursued and killed him. And it was but yesterday that civilized man became acquainted with this animal.

Even today, some thirty years or more after the discovery of the okapi, few white men have been able to see him in his native environment. For the okapi's home is extraordinarily difficult country to reach—the heart of the Belgian Congo. And few white men have the abilities or the resources to study the okapi at home.

Those who have seen him tell of a very shy animal, an animal that moves through the dense tropical vegetation with the quietness of a wraith, an animal so marked that he blends with his environment almost to a point of invisibility. But for those few people who have had the rare luck to get a good look at the okapi, there has been a thrill as great as might be imagined in looking at some

mythical grail. They have seen a large animal, about as big as a horse, with a brownish red coat, with creamy white legs and white horizontal stripes on the upper fore-limbs and the hind-quarters, with a rather long, narrow head and tremendous ears, and in the adult male with a small, spike-like, hair-covered horn above each eye.

Now thousands of visitors to the Zoological Park in New York may experience the rare pleasure of viewing a live okapi, a privilege that hitherto has been limited to the inhabitants of one or two European capitals and to the few explorers who at great cost and effort have sought the okapi in his deep forest home. And for the appreciative visitor it will be an unique experience to look through the bars at this living fossil, this persistent ancestral type of giraffe, and then to walk across the corridor to see his highly specialized and elongated descendant, the spotted giraffe of the African veldt.

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BEFORE MAGELLAN

Continued from page 77

and it was many years before they returned in sufficient numbers to become the staple food of the people. Then, abruptly as they came, the things belonging to this third group leave the picture, and if we read the signs correctly their right to the land was disputed by a fourth tribe using small, rough arrowpoints. For at another site on the level of the end of the third period, two group burials were found containing the remains of nine men and women and one baby. One of the skulls shows an ugly gaping wound. The absence of weapons of the third type in the subsequent debris tells the result.

Shortly before the beginning of Patagonia's written history, perhaps in Magellan's time, the small arrowpoints of the Ona Indians record their visit to Fell's

Cave. If a guest book had been kept there during the years the story could scarcely have been written more plainly.

Later, at Palli Aike, we found the same sequences and by recovering a greater amount of material were able to eliminate some of the questions. That cave had been visited at an early date but the first callers forgot to sign the register and left nothing which would serve to identify them. For a while it was used only by sloths who, dying there, added their bones to the rising floor. Then either the adjoining or a nearby volcano erupted throwing in tons of fine ash and lumps of lava. This leveled and smoothed the floor and was seemingly the renovation needed to attract the local population.

First it was used as a place for the dead. Two adults and one child had been placed in hollows along the wall, covered with grass and brush and cremated. Im-

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bedded in the volcanic ash was a single point of the oldest type found at Fell's hinting that they may have lived in that period. Then the second or bone-point people follow and in their fireplaces are the bones of sloths and horses proving that they had arrived in the south just prior to the complete extinction of those animals. The balance of the record only confirmed what we already knew.

Back in New York after an absence of two and a half years, with the dust of Palli Aike gradually wearing off, one feature of our experiences stands out above all the rest. That is the fact that in all the time spent there we failed to find a single person, government or naval official, estanciero or businessman, mechanic or peon who did not treat us as friends and help us in every way possible. May their mounds grow to unrivaled size and record a prosperous history.

not be overlooked. The English have notoriously bad teeth, although in this instance also no one knows to what extent this is the result of environment or of genetic factors. Circumstances, however, suggest that heredity and inbreeding may play a part in the degeneracy of the Pitcairn dentitions. Edward Young, one of the mutineers, was described in contemporary records as having lost his incisor teeth although only 24 years of age. Since the incisors are not among the most resistant teeth, their loss at such an early age suggests either fisticuffs or a congenital defect. If the latter is the correct explanation, it is easy to see how the intensive inbreeding practiced on the island could soon spread the defect to all the families of the community. Although this is purely hypothetical and difficult to prove, it is of interest to observe that the descriptions of the islanders, before inbreeding had become widespread, make a special point of the beauty of their teeth.

Although these brief notes on the Pitcairn Islanders make no claim to be exhaustive, they cannot be brought to a close without mention of the daily life on Pitcairn. I have in another place* described in ampler detail the manner in which the Pitcairn Islanders lived in the past and the characteristics of their life at present. The contrast revealed that the influences of modern civilization reach even this remote community. Cloth has replaced tapa, metal pots and pans have changed the prevailing form of cooking, gramaphones have introduced jazz, and corrugated iron has been substituted for thatch. A present day Pitcairn home usually contains old-fashioned furniture, sent out by friends in England or America, home-made benches, chests and tables, and tableware collected from various ships. The islanders obtain much of their clothing from sailors and ship's officers and from their friends abroad. Some of their necessities such as sheet metal, tools, glass and similar articles they purchase from the scanty earnings they make by the sale of curios, fruits and vegetables to passing ships.

The men spend most of their time tending their plantations where they cultivate a wide assortment of common vegetables as well as such staples as yams and taro. Fishing represents a secondary source of food. The remainder of their time is occupied in caring for poultry and goats, in chores and in the manufacture of curios from native woods. The women, in common with their sisters elsewhere, devote themselves mainly to their families and household tasks. In their spare moments they weave baskets to be sold when the steamer calls. Once a year each family retires to the far side of the island where they boil sea water to extract salt. Two weeks of this work ordinarily is enough to furnish a year's supply.

The communal life of the islanders has its origin in tradition, and it has been fostered by the nature of their island

* "The Heritage of the Bounty," N. Y., 1936.

home, inter-marriage and necessity. The first generation, raised under the patriarchal egis of John Adams, established the pattern of behavior which has continued for over a century. Although land is held privately and inherited within the family, the islanders are generous to each other in granting privileges of cultivation. Boat-building, road-work, repairs on the church or school are all community enterprises. The school is maintained by the community for all children from the ages of 6 to 16. The islanders are self-governing, the men and women electing officers annually.

But the center of Pitcairn life is the church. Formerly the islanders were adherents to the Church of England but in 1886 they were converted en masse to Seventh Day Adventism. There is a story on Pitcairn that the community was divided on the question of conversion, the majority favoring the new dispensation. With great foresight the minority group determined with considerable reluctance to join the majority in order to preserve unanimity in their religious activities, fearing that in so small a community a division on churchly matters might create a constant source of ill-feeling. The Sabbath is celebrated on Saturday by three services, and other days in the week are frequently devoted to additional meetings. Tithes are collected from all the islanders for the benefit of the church and for contribution to the missionary fund.

Among themselves the islanders employ a dialect ungrammatically compounded of English and Tahitian. It is spoken with a peculiar intonation and enunciation which invest common words with an unfamiliar character. Some of their expressions clearly exhibit the inter-action of Polynesian and English influences. For example, emphasis in Tahitian is often expressed by reduplication. The islanders using an English word such as "bony" reduplicate it into "bony-bony" to mean excessively thin. Another is "illi-illi" which derives from hilly and means very rough, as in describing a tumultuous sea. "Fut you ally comey diffy and do daffy" readily suggests its meaning: why do you come and behave that way. The reader may reconstruct "do this way and do that way" from "diffy and do daffy."

Aside from the human interest of Pitcairn life, there is another aspect of the cultural adjustments of this community which is worthy of mention. Pitcairn provides an example of the consequences of culture contact, reflecting within its microcosm forces which are often difficult to assess in more complex societies. It is especially advantageous for such a study because the colony was established on a remote and uninhabited island where cultural adjustments could find their solutions uncomplicated by extraneous influences. Having achieved a cultural equilibrium the islanders then came under the influence of American and English whalers who in the 1830's and 1840's resorted to Pitcairn in great numbers. From then on the Pitcairn community came to depend more and more on the outside world as they increasingly abandoned their cul-

tural independence. But for the brief moment of its existence a distinctive and unique culture did flourish on Pitcairn.

The mutineers and their Tahitian wives, lacking the material equipment of their cultural heritages, created a new synthesis by following familiar models, integrating one with the other and developing new traits to fit the special conditions of Pitcairn. I have tabulated the origins of a number of Pitcairn traits with the following results. In 17 characters the inspiration was clearly Tahitian, in 12 it was English, and in 8 independent development was apparent. In the household arts, cooking, preparation of food, tapa-making, types of clothing, etc., the Pitcairn Islanders borrowed from Tahiti. In other departments a more even distribution appears. Handicapped by the absence of nails, glass, and carefully dressed timber the early Pitcairn Islanders developed a type of house construction which admirably illustrates the dovetailing of borrowing and invention to achieve a novel and efficient result. The frame of the early Pitcairn house was mortised into heavy undressed logs which rested on large foundation stones. Roughly dressed planks were fitted into grooves previously cut on the opposing faces of uprights let into the foundation logs. Sliding shutters, similarly constructed of planks fitted into a grooved frame, were built into the long openings on one side of the building. The roof was thatched with pandanus. Within the house long bunks were built against the inner wall opposite the window. Thus, the use of timber comes from English custom, the sliding shutters and the bunks from naval architecture, the pandanus thatching from Tahiti and the construction without the use of nails from necessity. Even after the lapse of over a hundred years a number of these sturdy houses are still standing.

JAPAN—A LAND OF NATURAL DISASTERS

Continued from page 15

Among the pranks of this typhoon were the over-turning of trains by the 130-mile-an-hour wind, the sinking of eight thousand ships and boats, the destruction of nearly three hundred schools, flooding of one hundred thousand homes, injury of nine thousand people, death of three thousand and property loss to the tune of three hundred million dollars.

But "Shikata ga nai," says Japan, "It can't be helped," and rebuilds. Disaster in one form or another as the daily food of Japan has bred a stoical, bullheaded people who know how to fight because they have had a hard drill-master, Brute Nature. There is also a Mother Nature in Japan, gentle, lovely, artistic to a high degree. The charm of the Japanese environment, together with the rigor of physical forces, must have had much to do in the molding of that curiously two-sided individual, the Nipponese . . . aesthetic and indomitable . . . a man compounded of cherry blossoms and iron.



WHAT IS IT THINKING?

CHAS. R. KNIGHT 38

February NATURAL HISTORY 1938

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FEBRUARY, 1938

Young Lioness.....	Cover Design
<i>From a drawing by Charles R. Knight</i>	
Star Ruby.....	Frontispiece 84
What Are They Thinking?.....	Charles R. Knight 85
<i>Facial expressions, postures and movements are keys to an understanding of animals</i>	
Your Indoor Desert Garden.....	T. H. Everett 93
<i>South African succulents are among the most decorative indoor subjects</i>	
Natural History for Everybody.....	Donald Culross Peattie 103
<i>Nature lies at your backdoor</i>	
Depression and Revolt.....	Clark Wissler 108
<i>The story of the last Indian uprising and its Youth Movement</i>	
How Old Is a Gem?.....	Herbert P. Whitlock 113
<i>Hall marks of the gem cutter's period and country are left as clues to what queen the jewel adorned</i>	
If You Died in Old Peru.....	119
<i>A mummy bundle shows that it has gone through four separate burials</i>	
The Evolution of Plant Life.....	Alfred Gundersen & Maud H. Purdy 126
Tales of Attacks by the Ocean Gladiator.....	E. W. Gudger 128
<i>How the swordfish wreaks occasional vengeance</i>	
Aruba—Cinderella of the Caribbean.....	Juanita DesBriere 138
<i>A forgotten island comes into her own</i>	
Millions for Defense.....	Hendricks Hodge 141
<i>For self-protection plants develop formidable defensive weapons</i>	
The Indoor Explorer.....	D. R. Barton 149
Your New Books.....	152
Science in the Field and in the Laboratory.....	155

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STAR RUBY

THE EDITH HAGGIN DE LONG STAR RUBY, recently presented to the American Museum and placed on display, is the finest and largest gem of its kind known to exist in the world. Its color is a peculiar milky crimson which can best be described as "orchid red." This stone is an important addition to the Museum's collection of corundum gems, which, under the curatorship of Herbert P. Whitlock, has become the most complete series in the world. The curious and beautiful six-rayed star which glows within the gem results from a myriad of minute hollow tubes which are distributed throughout the crystal with great regularity, parallel to its six sides. When

cut *en cabochon*, so that the rounded dome arches over this hexagonal pattern of cavities, stones of this kind reflect the light from the *interior* as a six-rayed star and are consequently termed star rubies and star sapphires.

This gem was discovered in one of the ruby mines of Burma a few years ago and was presented to the Museum by Mrs. George Bowen de Long, in whose honor it has been named. It is unique among star rubies and the largest of such rubies even remotely approaching it in quality.



WHAT ARE THEY THINKING?

Characteristic facial expressions, postures, and movements are the key to an understanding of animal psychology and the soul of animal art

By CHARLES R. KNIGHT

With Drawings by THE AUTHOR

You have probably often been among the thousands who visit the scores of zoos each day throughout the world. Then you may well ask yourself how far you were able to deduce the emotions and thoughts of the animals you watched, for this is the keynote of the pastime of understanding animals and of the art of portraying them realistically with pencil, brush, or modeling clay.

Some morning when you are feeling particularly alert and fit, stroll into the lion-house and notice

how quiet everything is in the various cages. Our lordly friend—the Bengal Tiger—is probably asleep, lying on his back, feet in air, in an attitude of complete relaxation. The King of Beasts himself (not quite so kingly at this early hour) is just waking up, yawning, stretching himself and gazing lazily about in a rather owlish fashion. A restless leopard paces slowly back and forth, and the lion-cubs are having their morning toilet. How they snarl and shrink away as the rough tongue of the lioness

CHARLES R. KNIGHT's murals and other paintings are displayed extensively in museums and private collections, and his works have set a standard throughout the world in the painting of both modern and prehistoric animals. Early in life he attended the art school at the Metropolitan

Museum, and later pursued his studies at the Art Students League. He has studied the anatomy and movements of living animals both in the zoos of this country and those of Europe. His versatility and unique genius are evident in the uniform excellence of his animal pictures, landscapes and

portraits. Mr. Knight is the author of *Before the Dawn of History*, which is widely read by the public and used in educational institutions. Another book on prehistory for younger readers and also one on Comparative Psychology and Anatomy of Animals will shortly appear in print.—THE EDITOR.

washes the dirt and grime from their soft and yielding bodies! Everything is peaceful here at present, a perfect cow stable or sheepfold atmosphere pervades the place, with no signs of the fierce and savage traits that will manifest themselves later in the day when hunger and the sight and smell of food arouses these inherent characters.

Slowly as the hours pass, a subtle change comes over the assembled felines. First one and then the other rises and begins to walk, exercising if you will, but not consciously we may be sure. Occasionally dreary howls come from the tiger's cage where the great striped brute is already casting off his figurative sheep's-clothing and gradually changing before our very eyes into the ferocious killer of the Indian jungles. Lions, both male and female, are practicing in concert heavy, dour and terrible sounds that in their native Africa strike terror to the herds of game coming down to drink at the water-hole. Leopards, pumas, jaguars—all are slowly but surely disclosing to our awed and interested eyes just what it means to be a hungry carnivore. But if you have not observed them with more than usual attention you have not discovered how differently from other animals these creatures exhibit their feelings and thoughts.

Feeding time

Noon-hour has passed and an ever-increasing excitement is apparent among the inmates of the great cat house. Ever fiercer and more continuous are the growls, snarls and roars of the now really hungry felines which seem to know almost to a minute the time when the door at one end of the long building will open and admit the keeper, wheeling in a barrow the daily supply of fresh meat. Feeding time at last!

The odor of bloody flesh strikes nostrils well accustomed to the smell, and then a sort of frenzy breaks loose all along the line of cages. Our tiger, no longer a sleepy, docile looking creature, leaps back and forth in the narrow confines of his den—fire flashing from the golden eyes, the great fore-paws armed with wicked looking talons stretched eagerly forward to seize the food thrust under the bars at the front of his cage. A harsh coughing roar greets the keeper as the huge piece of gory flesh is snatched from the iron fork and the long, yellow canines close over it with a vise-like grip. Determination, ferocity, power—all these flash before our eyes—*emotions* (not anatomy) impress themselves upon our vision at this crucial moment and we as human beings are afraid, aghast, before this exhibition of tremendous and terrible energy. Back rushes the great striped beast to the farthest corner of his cage

where, crouched low over the coveted repast, he alternately growls and bites off great pieces of meat which he swallows whole. In no time only a broken shin-bone or a shoulder blade remains of what was after all a meager portion of food for so large an animal. These gruesome objects are soon rasped clean by the rough pink tongue, and again a curious somnolence comes over the lithe and sinewy body of the great cat.

The water which the keeper brings and pours into a shallow pan is lapped up eagerly but now with no terrible growlings or show of anger. For the tiger, the business of the day is finished and there is nothing ahead of him but sleep, exercise and a looking forward to the same sort of repast twenty-four hours hence.

We have just seen (perhaps with rather startled eyes) a major example of what constitutes a very interesting phase of feline nature, but are we able to analyze and possibly reproduce on canvas or in clay, or even accurately describe, just what has so lately and forcibly impressed us? I feel certain that we can *not* unless we have had a great deal of previous training. Have we noticed for example just how the tiger crouched to grasp his fancied prey or what emotion he is showing at the moment, and how that emotion will be expressed anatomically? Evidently the intense desire for food has temporarily transformed the erstwhile mild and placid beast into a fiend incarnate, and strange things have happened in the big cat's brain to alter his usual mood of callous indifference. Rounded ears were back and down, held tightly against his head; the great eyes blazing with a greenish fire; and the terrible jaws widely opened. Lips drawn back; nose wrinkled and whiskers pointed forward; canines exposed, and curled up tongue—all served to create that terrible and sinister facial mask without a parallel in the whole realm of animal life.

Long observation

And how, we ask, does one succeed in observing all these points when everything happens so quickly? For answer, we can only say that practice and familiarity with what is *likely* to occur allow us to register, however imperfectly, the fleeting phases of the profound emotion we have just witnessed. I have dwelt at some length upon these mental and muscular reactions of a tiger under a given stimulus because they are typical of all the feline tribe, both large and small, and present a striking contrast to what occurs in the case of a horse, for example, under the same conditions.

This latter animal, a swift-running, grass-eating creature, must of necessity be built on very different

lines from those of the flesh-eaters. Yet it can and does show anger, fright and kindred expressions whenever the necessity arises. Food, for an animal of this type, is easily procured and involves no struggle with a victim or another individual of its own species. Hence no powerful emotions are involved, no show of anger, no bodily contortions. Yet the horse on other occasions may exhibit tremendous and violent action. A stallion fighting with another male displays extreme ferocity as, rising on its hind legs, it strikes terrible blows with the fore feet or seizes its adversary with its powerful teeth, cutting, slashing and maiming a weaker or more timid antagonist. Mares on the other hand wheel and kick with their hind legs delivering a shower of well directed blows against a real or fancied enemy. Indeed a vicious horse, in its own way, is quite as formidable as the tiger itself, especially in captivity where its lack of fear of man counts heavily in its favor. Primarily, however, the horse is in all its actions far removed from the flesh-eaters and certainly in a wild state depends upon its superior speed and stamina to out-distance its enemies. Standing gracefully on its one-toed feet, long-legged, deep-chested and powerful, it is eminently fitted for a life in the open where speed and endurance count so much in the struggle for existence.

Rarely do we see animal reproductions that reveal a truly profound insight into the character of the creature represented. A survey of many contemporary works suggests that a too superficial knowledge of this fascinating branch of artistic expression has proved a distinct handicap to otherwise clever producers, and that a closer study of the living animal would be of great advantage to the profession as a whole.

Movement baffling

Animal painting is a difficult art, more particularly if one is serious minded and not just dabbling with no real aspirations in any particular line. The mere fact that, as a rule, our animal model is in more or less continuous motion in no wise lessens our problem, and the play of the muscles over the body skeleton as the creature moves to and fro is calculated to make a beginner decidedly head-weary before many hours have passed. The various and complicated motions of so familiar an animal as a horse when walking, running or jumping are full of a peculiar rhythm, but owing to the rapidity with which these movements are executed, they are certainly baffling to the untrained eye, whether we regard them as subjects for artistic rendering or as physiological material of a very interesting sort. Indeed, a day spent before a restless animal will

probably send one back to the studio in a rather chastened and humble mood.

But don't let us be discouraged at these first attempts, because after all we may be able to produce fairly good things from *quiet* models, landscapes, perhaps, still life or even human figures—objects which stay put as it were, and which do not get up and walk right out of the picture or curl up and go to sleep in a dark corner! Apparently it may all resolve itself into the fact that we are not sufficiently prepared to do the work which seemed so easy at the start, that it has proved to be far more difficult than was at first apparent and perhaps it behooves us to begin all over again and get at the subject in quite a different way.

Far more than in figure painting, therefore, is it necessary to know something of the anatomy of the creature you desire to portray, and you simply *must* acquaint yourself with the important points in its general physical make-up. But one must also have an insight into the psychology behind the animal's actions because this psychology is the controlling element in its emotional responses.

"Animal pantomime"

The student is, therefore, strongly urged to study what we may call "animal pantomime." For it is the actions and postures which an animal displays that reveal its principal emotions—fear, anger, curiosity, sex attraction or repulsion. This being so the writer, a worker of many years standing, desires to call attention to certain important points about this fascinating subject—points which he believes, after long experience, will be a help to those similarly interested.

Our tiger stands forth as a shining example of lithé and rhythmic motion and beautiful color controlled by a rather crude mentality and an innately ferocious disposition as befits a real killing mechanism. Between this animal and the swift but non-aggressive horse, whose herbivorous habits are reflected in a disposition at complete variance with the typical flesh-eating animals, there are many other types, each with its peculiarities, mental and physical, strongly developed and unique in their way. Elephants, camels, horned animals—as the cattle, sheep, deer, antelopes, etc.—the swine, the bears, dogs and a host of others are all wonderful and interesting creations in the sphere of mammalian life. All are rare combinations of mental and physical characters in which either as artists or students of animal behavior, we will find endless opportunities for study.

You have seen that the reactions to a given emo-

tion are quite different in a tiger and a horse; and in turn the pose that will be assumed by an angry bull, dog, or deer is likewise distinctive. Animals that have found themselves in possession of some outstanding advantage (such as the horny head growths in creatures like the cattle, deer and goats) are very quick to make use of the superior powers and change their method of attack and defense accordingly. Consider, for example, how a bull or a stag when alarmed or angry instantly lowers the head in an attitude of defiance, and when sufficiently excited charges at full speed against an adversary. No such action as this is noticeable in our tiger or horse simply because their fighting implements are employed in an entirely different manner. It would seem as though the presence of the sharp and dangerously pointed head growths actually impressed itself upon the mentality of the animals. The stag as an instance (whose antlers are shed annually) will, when in a hornless condition, depend entirely upon its sharply pointed hoofs in fighting, feeling no doubt the lack of its former, well-developed safeguards. On the contrary, weak spots in the anatomy are also realized by the creature possessing them and one sees an elephant raise the delicate and sensitive trunk high out of harm's way in avoiding the charge of an angry tiger, at the same time trying to crush the infuriated cat under its massive forefeet.

The drawing on the cover of this *NATURAL HISTORY* is of a young lioness observed by the writer in a zoological garden. Her expression denotes maternal anxiety, for a keeper was moving about in the distance and she is watching him closely for fear he may approach and steal or molest her cubs. Alert and fiercely determined to defend the helpless babies at all hazards, the female lion is a most dangerous antagonist to either man or beast. In this case the man is too far away to elicit a demonstration of anger from the big cat, but a closer approach would instantly transform her anxious expression into one of extreme ferocity.

Psychology of animals

Both in clay and on canvas, the writer feels, and he trusts with reason, that over-emphasis has perhaps been laid in recent years upon the necessity for knowledge of animal anatomy without sufficient importance being ascribed to the psychological aspects of the same problem. That the two things are very closely connected seems to be beyond dispute and as a concrete example of their successful combination let us look at the work of the great French animal sculptor of the last century—Antoine Louis Barye.

This man working in the poorly exhibited collections in the *Jardin des Plantes* in Paris was nevertheless able, by dint of hard work and great genius, to produce many splendid examples of animal sculpture, which have not been equaled, let alone surpassed, in this generation.

His marvelous small bronzes of feline animals in action, his splendid elephants, bears and many other creatures are all exceedingly "alive," filled with energy and correct as to both anatomy and psychology. He seems to have understood thoroughly the mental attitude as well as the physical proportions of his models, so that when he makes a tiger seizing a crocodile, or two bears fighting, one feels instinctively that the attitudes and the anatomy are correct. In other words the tiger is grasping the saurian in a truly tigerish fashion and the bears fight and wrestle with one another just as you have seen them in your visits to the zoo. Mind controlling matter is very evident in these groups and Barye chose the only logical approach to his subject when he so successfully combined the two. It seems necessary, therefore, that we work more or less from the inside out to do a really fine painting or model of an animal and no amount of merely artistic technique in the superficial finish of our production will compensate for a lack of knowledge on this vital point. Both mentally and physically we must to a certain extent "feel" the attitude we wish to portray in order to grasp the co-ordinated rhythm of the animal's body and mind under a given stimulus of emotion. Lack of knowledge on this important point is what makes so many attempts at animal portrayal rather poor, meaningless accomplishments without truth or interest.

An understanding of the principles often enables one to understand what is wrong with a painting or model which otherwise is only vaguely "not just right." You have no doubt seen animal actors on the screen who are made to go through the motions but do not convey an authentic impression of the emotion intended. One can almost see the director off-stage with a biscuit in his hand. A poor animal painting is just as incongruous to a practiced eye. It cries out that the artist has not created the right emotional effect.

Action without distortion

The artist must also take care not to distort anatomy under the delusion that he is thereby increasing the action of his figure. Mere distortion is not necessarily action—that is not *true* action—even though the physical framework of an animal may under certain abnormal conditions assume the pose we have indicated. Correct rhythm is always beauti-

ful, majestic and inspiring and represents perfect muscular control so that we should always strive hard to attain this effect in our work in paint or clay. Never forget the mind behind the muscular action. The boxer's pose differs greatly from that of the fencer because the mental objectives are quite unlike each other, and they are both good examples of the fact that it is really the position of the bones of the skeleton rather than the shapes of the muscles which contribute action to a figure. The muscles of a tiger, for example leaping upon its prey, are not greatly different from those of the same creature in a reclining or walking position, but the placement of the bones, particularly of the limbs, is vastly different. Muscles, of course, clothe and move the bony framework of the body and contribute their own peculiar forms to the silhouette, but they merely serve to soften the outlines of the skeleton which fixes the attitude of any given figure—man or animal—upon the retina. One may see this point well exemplified in the splendidly mounted skeletons of horses in the Museum collections where without a vestige of fleshy covering, the attitude of the bones themselves convey to the mind of the spectator a perfect picture of the creature in motion.

Still another phase of this many-sided subject may prove of value to the potential art student and even the interested layman, and that is the very great differences in the proportions of certain sets of bones in various species of animals.

Diverse postures

All the mammals—man himself excepted—are essentially four-footed. The great apes do, on occasion, progress for a time on their hinder pair of limbs, but their usual method of walking is on all fours. Birds on the other hand are two-footed, the fore legs being converted into flight organs by the addition of the feathers. Reptiles again use all four limbs in walking or standing. One hardly realizes unless after careful observations, the many strange and diverse attitudes assumed in walking, standing or reclining by a number of well known types, as for example by the elephant, camel, bear, cat, horse and dog. Of all mammals the elephant is the only one that may be really said to *kneel* when reclining. That is, his true knee joint, the first below the hip, actually touches the ground while his very short hind foot sticks straight out behind. Camels also touch the knee joint to the earth, but their long hind feet are sharply bent at the heel or ankle joint and come forward again *inside* the lower leg, a most confusing and unusual pose. Bears lie while resting on their bellies, the whole of the hind leg back or with

the knee upraised—the man-like hind foot pressed to the earth. Cats, dogs, and their allies also have the knee upraised, the foot touching for the entire length. Horses, cattle, sheep, antelopes, deer and goats twist the hind quarters sideways, one leg under them and one leg free as in the dog or cat. Just why these differing positions should be assumed we cannot truly say, though in the case of the elephant it would seem to give the enormously heavy creature greater facility in rising from the ground to a standing position. While the foregoing points are strictly anatomical facts as always there must be some powerful agency at work which guides the muscular and bony form in certain very definite directions, producing as usual complete harmony in the creature's make-up.

Peculiarities of the elephant

For some reason, the elephant although much used in the art of certain countries is seldom represented with a true knowledge of its real characters. The tusks themselves are very difficult to draw, and their proper position and growth in the head of the pachyderm will require close observation. They are usually and absurdly indicated as growing from the lower instead of the *upper* jaw. As a matter of fact, the tusks are merely very much elongated and specialized upper incisor teeth, growing downward on either side of the trunk from a point in front of the eye-sockets. Also their shape and manner of growth is most peculiar as they turn in a sort of cork-screw fashion throughout their entire length. First down and out then up and in—a very subtle twisting form difficult to understand and portray.

Psychologically the elephant is, of course, a most interesting animal, big but intelligent, easily trained and with a most extraordinary command of its huge and ungainly body. The flexible and unique trunk is its most distinguishing feature, but mentally and physically it is unlike any other animal now living. The gait is peculiar—a swift shambling walk or amble, the foot-falls being very close together and well under the body. All in all a majestic and impressive creature—one of the strangest and much the largest of all the land-mammals of our time. In this huge and massive brute we see to perfection the superior intelligence which so successfully controls the massive body, the marvelous proboscis with its powerful and well directed mechanism, the gigantic form and the great post-like legs executing under direction seemingly impossible feats of skill—all requiring balance, strength and brains to a surprising degree. Thus we might proceed indefinitely in our survey of the life about us for with increasing knowledge a fresh vista of interesting phenomena opens

Continued on page 148



CHARLES R. KNIGHT 36.



CHARLES R. KNIGHT 36.

RAGE IN THREE GUISES. Different animals express the same emotion in many different ways. Above are shown a bear, a bull, and a horse in their characteristic postures of anger. A bear that has risen on his hind feet, with teeth bared and fore paws ready to strike, is a bear to be feared

A BULL, on the contrary, instead of rearing up, lowers his head and charges full speed with sharp horns foremost. Other horned animals use a similar attack, but a stag, when it has shed its antlers, will use only its hoofs, apparently realizing his seasonal disability

THE TIGER stands forth as a shining example of lithe and rhythmic motion controlled by a rather crude mentality and an innately ferocious disposition as befits a real killing mechanism. The three drawings at the right show the change of expression and posture of a tiger in three successive emotional moods. Note the change in the angle of the ear, which is one of the telltale features



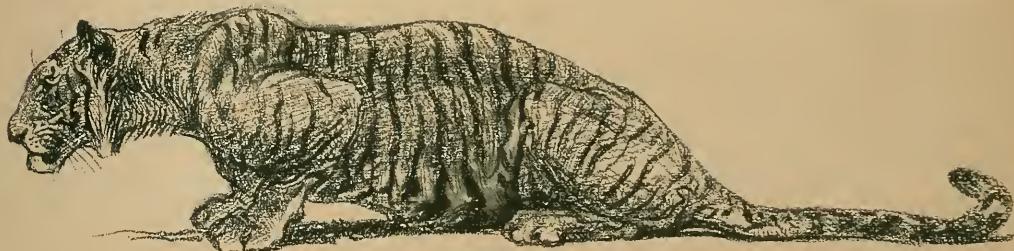
CHARLES R. KNIGHT 38.

RELAXATION is evident in every line of the tiger that is thinking neither of food nor an enemy. The neck is comfortably at ease, the ears are at rest, and the eyes are focused on nothing in particular. Here the dangerous killer of the Indian jungle shows almost the complacency of a house cat



CHAS. R. KNIGHT
38.

AN ANGRY STALLION, as shown above, will display extreme ferocity, rising on its hind legs and striking terrible blows with fore feet or seizing its adversary with its powerful teeth. A mare, on the contrary, will wheel and kick with her hind legs. Though a frightful adversary, the horse is far removed from the flesh-eaters. Standing gracefully on its one-toed feet, long-legged, deep-chested and powerful, it depends primarily on its speed and stamina to out-distance its enemies



CHAS. R. KNIGHT
38.

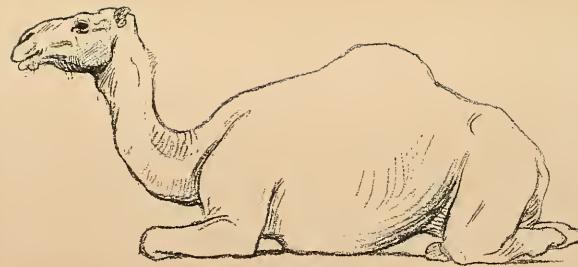
(Above) AT THE APPROACH of possible danger the tiger lowers its head and flexes its legs for rapid forward movement. The ears go alertly forward and the eyes and nostrils grow sensitive in the effort to size up the foe

(Right) The ears are thrown back as the beast, suddenly ferocious, bares its teeth and emits a terrifying roar

WHAT ARE THEY THINKING?



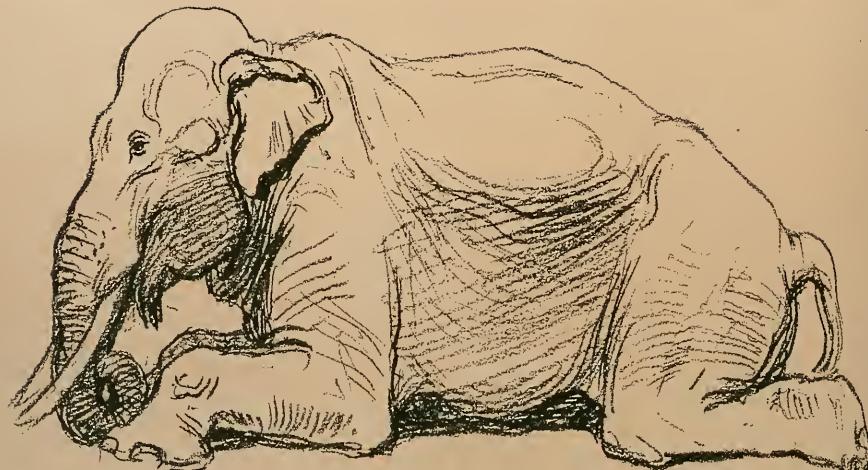
CHAS. R. KNIGHT 38.



CHAS. R. KNIGHT 38

MANY STRANGE and diverse "sitting" postures are displayed by different well-known animals. The camel is one of the few animals that touches the knee joint to earth. The long hind feet are bent sharply at the heel or ankle

and come forward again *inside* the lower leg in a most confusing and unusual pose. Horses, cattle, sheep, antelopes, deer and goats twist the hindquarters sideways, one leg under them and one leg free



CHAS. R. KNIGHT 38

THE ELEPHANT is the only mammal that can really be said to *kneel* when reclining. His true knee joint, the first below the hip, touches the ground while his very short hind foot sticks straight out behind



CHAS. R. KNIGHT 38

ATTENTION and a trace of anxiety are shown in the lioness at the left. This attitude may instantly change to one of rage, with ears back and fangs bared

YOUR INDOOR DESERT GARDEN—Transplant a corner of South Africa in miniature and you will find her "camels of the plant world" among the most interesting and decorative indoor subjects



CRASSULACEAE
PYRAMIDALIS

DRAWINGS
BY NATALIE
HARLAN
DAVIS

By T. H. EVERETT
N. Y. Botanical Garden

SOUTH African plants are enjoying a well-deserved and increasing popularity with American gardeners. The flora of that far-away land is so infinitely rich that some, at least, of its representatives can be grown by everyone interested in plant culture. Not even the city-gardener

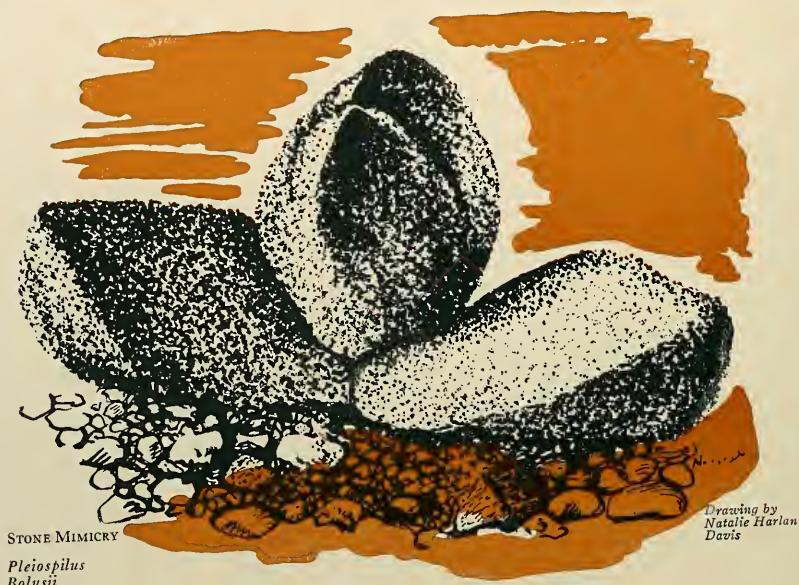
is excluded, for a sunny window will provide an acceptable home for a great variety of the smaller succulents.

South Africa is particularly rich in these, and they are as well adapted to dry atmospheric conditions as are the cacti of our American deserts. Once their simple needs are understood they present no difficulty to the cultivator and their curious forms, rich color-

ings, and beautiful flowers render them objects of continued interest and admiration.

Botanists restrict the use of the term "succulents" to plants which are possessed of fleshy, water-storing tissues and which are provided with various devices to conserve their water supplies so that they are enabled successfully to live through prolonged periods of drought. They are the camels of the plant world. Novices sometimes refer to all such plants as "cacti," but this is wrong, for the cacti include only those succulent plants which belong to the family Cactaceae, and in nature these are practically re-

any. Describing one of the stone plants (*Pleiospilus Bolusii*) a famous South African student of this group says: "It generally produces only two leaves, which grow to the size of a duck's egg. Their surface is rough like weathered stone and their color a brownish gray with a touch of dull green. The leaves are half buried in the soil or between the stones among which the plants grow, hence it requires a keen eye to detect them when not in flower. In autumn, however, when bright yellow flowers about two inches in diameter appear between the leaves, the plants are very showy. But this does not



stricted to North and South America. Both in the drier parts of the Americas and in other arid and semi-arid regions of the globe are found succulents belonging to families other than the Cactus family.

The remarkable "stone plants" as well as the curious "windowed plants" belong to the Fig-Marigold Family. The former have adopted a form of protective mimicry and closely resemble the stones and pebbles among which they grow naturally. So effective is their disguise that South African Collectors record that they have searched for hours in places where the plants are known to grow before finding

last long, and during the dry season the leaves look just like lumps of stones."

One of the most curious of the stone plants is *Didymaotus lapidiformis* which is restricted in its natural distribution to bare plains, the surface of which is composed almost exclusively of intermingled fragments of two kinds of shale, one rust colored and the other slate colored. These angular stones form a level surface and among them the rough leaves of the plant are scarcely noticeable, particularly as each individual consists of two pairs of leaves resting among the stones, the older pair rusty brown in color and the younger slate colored.

Several species of the genus *Lithops* so closely resemble pebbles or stones that visitors to the New York Botanical Garden find difficulty in distinguishing them from their surroundings. Doctor Marloth, who first introduced *Titanopsis calcarata*, writes "The leaves form a dense rosette, and their surface, as far as it is exposed, is covered with irregular excrescences that look exactly like the whitish fragments of lime-tufa among which the plant grows. No artist could imitate the surface texture and coloring of the limestone more accurately than nature has done in this case."

low. In some cases the windows are semi-transparent, in others almost as clear as glass. Of *Fenestaria rhipalophylla* Doctor Marloth writes "The plant grows imbedded in the sand, nothing but the flat, slightly convex apex of each leaf being visible and even that is often covered with more or less sand according to locality. While the leaf itself is fresh green with a rather delicate skin, the exposed part is protected by a thick epidermis and cuticle and possesses comparatively few stomata. It is through this portion, which has the function of a window, that the leaf receives its light. There are five to ten



"WINDOWED PLANT"

Haworthia
Retusa

*Drawing by
Natalie Harlan
Davis*

While the stone plants conserve their moisture and protect themselves from grazing goats and other animals by thickening their skins and by simulating their surroundings, the "windowed plants" achieve the same results by practically burying themselves below the ground. Only their tops reach the surface, the main body of the plant being subterranean. A remarkable character of these plants is that the tops of their growths are more or less transparent and thus serve as windows through which the light can pass and so reach the green assimilating tissue be-

or even more leaves to each plant, but nothing appears to the surface except these windows; they peep out of the sand like the eyes of the sand lizard or the sand viper, which often hide themselves in a similar way."

Both the stone plants and the windowed plants bear beautiful, daisy-like flowers in due season (usually in the late summer and fall). These flowers are large in proportion to the plants and are white, pink or yellow according to species.

The Milkweed Family affords the fancier of

South African succulents a very considerable number of curiosities which resemble dwarf editions of the columnar cacti or *Euphorbias* in their habits of growth. In many cases the flowers are large and showy and are usually of a sinister, somber, red-purple coloring. Many of the *Stapelias* and some of the *Carallumas* are possessed of an offensive odor when in bloom and so earn for their tribe the common name of Carrion Flower. This is a device which, together with the color of the star-fish-like flower serves to attract carrion-loving insects which transfer the pollen from flower to flower. No less curious are the *Trichocaulons*. They form soft, fat, rounded plant bodies of a bluish-gray-green color, closely set with angular small knobs or protuberances. The flowers, though small, reveal an astonishing beauty when examined under a hand lens.

The cultivation of South African succulents present but few difficulties once their simple requirements are understood. Strange to say, the mistake most easily made when growing them indoors is that of attempting to follow too closely the conditions under which they grow naturally. Experienced gardeners know that when plants are grown artificially and far from their native homes it is usually necessary to modify their environmental conditions and this is abundantly true with the succulent plants from South Africa. Another mistake which can easily be made is that of following too closely cultural practices adapted to English conditions, and we must remember that most of the literature upon the subject is based upon English experience.

Most of the succulents listed below are very easily raised from seed or cuttings. Seed of many kinds is obtainable from South African sources and from some dealers in this country. A variety of living plants can be obtained in America, particularly from the Pacific Coast region, but plants cannot be imported from South Africa except under special permit from the Department of Agriculture.

Seed is sown in pots or pans in very much the same manner as any of our ordinary garden seeds, except that the soil-mixture should be very sandy and care must be taken to provide an ample amount of drainage material in the bottoms of the receptacles. Care must be taken that the soil is not permitted to become wet and muddy at any time, but it should never be allowed to dry out thoroughly, for a moderate amount of moisture is necessary for germination and growth.

During their early life seedling succulents do best if given a very light protection from the full intensity of strong sunlight, and even mature specimens when grown in a greenhouse or in a window garden appreciate a little shade from the mid-day sun dur-

ing the hottest summer months. Seedlings grow much more quickly than is generally supposed and sizable plants are soon obtained by this method.

Cuttings of succulents give the best results if they are permitted to be in a sunny place for two or three days before they are planted in clean sharp sand. They are set firmly in the sand which is kept barely moist (but never quite dry) and are placed in a rather airy and light place until roots are formed, when they are transplanted to the regular soil mixture.

While the soil mixture used for dwarf succulents may be varied slightly and as experience dictates to meet the special needs of particular species, the grower must never forget the absolute necessity of having a rooting medium which is extremely porous and open. The mechanical condition of the soil must be such as to permit of perfect and immediate drainage, and if this matter receives attention other considerations are of distinctly minor importance.

The soil I favor and which meets the needs of a varied and representative collection consists of a base of heavy, fertile loam, modified by the addition of liberal quantities of coarse sand and coarse coal cinders, together with sandstone, flower-pot crocks or bricks broken to the size of peanuts. Broken tufa rock is also excellent. Fertilizer should not be used. The loam in this mixture very definitely forms less than half the total bulk. Members of the *Asclepiadaceæ* (Milkweed Family) appreciate a moderate amount of leaf-mold added to the mixture.

When potting succulents use clean receptacles and do not place them in pots too large and out of proportion to the size of the plants. Transfer them to larger pots only when the ones they occupy are thoroughly filled with healthy roots. In most cases plants will remain undisturbed in the same pots for several years. Always provide ample drainage—the pots should be at least one quarter filled with broken crocks or cinders. Remember that while the windowed plants grow beneath the soil surface in their native homes under our conditions they will rot away if so planted. Set them so that the plant body is above ground as with other succulents.

Succulent plants appreciate a free circulation of air and full exposure to sunshine except for brief mid-day periods during the hottest months of the year. They abhor shade and humid atmospheric conditions. Water must be applied with care, particularly in the case of very obese examples, but at no time should the soil in the pots be permitted to bake dry.

The succulents hailing from South Africa belong for the most part to eight families as follows:

1. FIG-MARIGOLD FAMILY (*Aizoaceæ*). Contains the

interesting "stone plants," *Pleiospilos Bolusii*, *Pleiospilos similis* (recently discovered and an even better mimic of its surrounding), *Didymaotus lapidiformis*, and other species in the genera *Conophytum*, *Dinteranthus*, *Punctellaria*, *Rimaria*, *Titanopsis*, *Gibbaeum* and *Argyroderma*. Species of the last three mentioned have white or light gray skins and thus simulate precisely the quartzite or tufa among which they occur.

This family also includes the remarkable "windowed plants" discussed above, of which fine examples are to be found in the genera *Lithops*, *Fenestraria*, *Frithia*, *Conophytum*, and *Imitaria*.

In addition the Fig-Marigold Family includes a number of other interesting dwarf succulents as *Trichodiademas*, *Delspermus*, *Glottiphyllums*, *Faucarias* and others.

latter pure white in bloom. Then we find *C. columnaris*, a wee dot of a plant which mimics its surroundings as effectively as any stone plant, and the odd *C. pyramidalis* with leaves so tightly packed together that the stem is entirely invisible and the plant appears as a neat, erect four-sided pyramid of green. Also here are such mites as *C. Alstonii*, *C. deceptrix*, *C. barbata*, *C. pachyphylla* and *C. hemisphaerica*. Brilliant red are the flowers of *C. falcatia* and this coupled with the fact that the strange sickle-shaped gray leaves are arranged in such a way that two rows turn to one side and two to the other, giving to the plant a flattened appearance, make it one of the most distinct and remarkable members of its family.

Roechea coccinea also has scarlet flowers and must be listed among the most decorative of plants when in flower.

PARTRIDGE
BREAST
ALOE
Aloe variegata

Drawing by
Natalie Harlan
Davis



2. MILKWEED FAMILY (*Asclepiadaceæ*). Contains a considerable number of curiosities in the genera *Stapelia*, *Huernia*, *Caralluma* and *Hoodia* which resemble dwarf columnar cacti; also the *Trichocaulons*, whose flowers, though small, reveal astonishing beauty under a hand lens, and the evil smelling Carrion Flowers (*Stapelia* and *Caralluma*). *Ceropegia* is also included among the Milkweeds and in addition to erect growing species this genus includes the bead-plant (*Ceropegia Woodii*) with fine trailing stems along which the small rounded fleshy leaves are strung. Other genera in this family well worthy of attention are *Tavaresia*, *Huerniopsis*, *Piaranthus* and *Duvalia*.

3. ORPINE FAMILY (*Crassulaceæ*). Comprises a wealth of small succulents of which only a few can be mentioned here. In the genus *Crassula* itself we have such attractive plants as the Christmas flowering *C. multicava* and *C. lactea*, the former with flowers of delicate pink, and the

It sends up many stems to a height of nine inches or so and these are furnished with four distinct ranks of short green leaves and terminate in flat inflorescences of brilliant flowers.

4. PURSLANE FAMILY (*Portulacaceæ*). Offers to the cultivator numerous interesting species in the genus *Anacampseros*. Some of these rather closely resemble small *Sempervivums* in general appearance and have bright flowers. *A. telephiastrum* is a good representative of this group while the vermiform *A. papyracea* with short more or less horizontal stems covered with white papery scales is typical of the other types. The latter have flowers which are insignificant in size.

5. SPURGE FAMILY (*Euphorbiaceæ*). An immense family, whose dwarfer South African succulents, however, may be listed briefly. Most remarkable of all is *Euphorbia obesa* which is exactly like a baseball of iron-gray color with finely marked longitudinal seams marking its

A SUNNY WINDOW will provide an acceptable home for a great variety of these miniature South African "succulents," which are as well adapted to dry atmospheric conditions as the cacti of our American desert, and more exotic.

(Below) A member of the Milkweed Family (*Huernia reticulata*) which affords the fancier a number of curiosities

Your Indoor Desert Garden

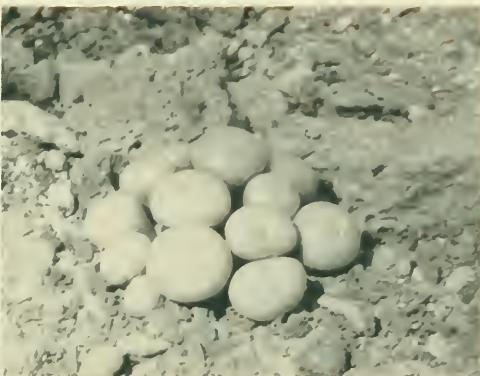


Ophthalmyophyllum sp.

Lithops sp.



(Above) THIS "SUCCULENT" (*Conophytum Pearsoni*) gives the appearance of having created its own flower pot to store moisture for growth in the arid climate of South Africa

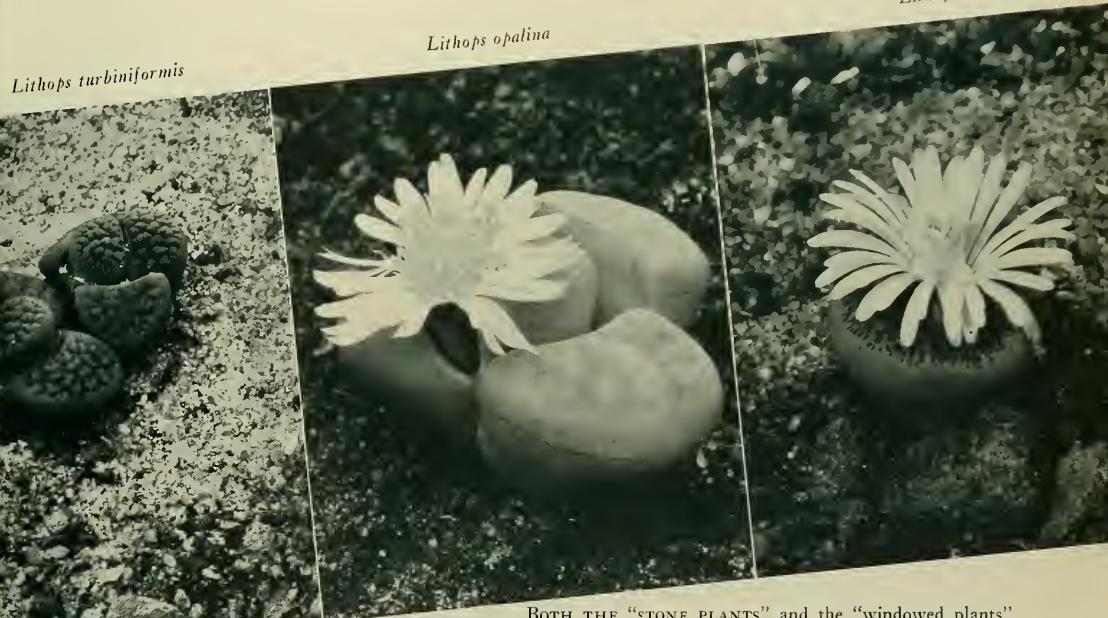


(Above) RESEMBLING a cluster of puffballs, *Conophytum cibellum* represents the curious specialization of "stone plants" in the Fig-Marigold Family

WHILE "STONE PLANTS" protect themselves by camouflage, "windowed plants" such as the species at extreme left, bury themselves in the ground and absorb sufficient sunlight through semi-transparent tissues. Through these "win-

dows," sometimes almost as clear as glass, the light can reach the green assimilating tissues below. THE GENUS *Lithops*, illustrated below by four species, contains many remarkable "window plants" and "stone plants"

Lithops Leslei



NUMEROUS SOUTH AFRICAN SUCCULENTS can be grown indoors from cuttings or seed obtainable from dealers in this country. With sandy soil kept reasonably dry, seedlings grow much more quickly than is generally supposed, and sizable plants are soon obtained. A rooting medium that is extremely porous and open is essential

BOTH THE "STONE PLANTS" and the "windowed plants" bear beautiful daisy-like flowers in due season, usually in the late summer and fall. These flowers are large in proportion to the plants and are white, pink or yellow according to species



WHITE OR LIGHT GRAY COLORATION enables *Argyroderma testiculare* (at left) and species of *Titanopsis* and *Gibbaeum* to simulate precisely the quartzite or tufa among which they are found



(Center) THE POINTED LEAVES OF *Mesembryanthemum tuberculatum* form a variegated background for its delicate flowers and illustrate the wide variety of available forms for one who wishes to cultivate these "camels of the plant world"



A WEALTH of miniature succulents suitable for indoor cultivation is provided by the well-known Orpine Family, of which the attractive *Crassula lactea*, with pure white flowers, is shown above



(Left) THE SMALL BRIGHT FLOWERS of *Punctillaria magnipunctata* are all that might distinguish this plant of the Fig-Marigold Family, at casual glance, from its stony setting

(Right) RESEMBLING the magnified egg of a butterfly, *Euphorbia obesa* is a worthy objective for the serious indoor gardener, for it does not produce offsets and good examples are rare



(Below left) A DWARF SPECIES of *Haworthia*, one of the most abundant and interesting groups for the fancier, exclusively South African



(Above center) SHAPED LIKE A PINE-APPLE, the fat rounded body of *Trichocaulon Pictum*(?) belonging to the Milkweed Family is set with small angular knobs. The flowers of the *Trichocaulons* of which another species (*T. dinteri*) is shown at center right, are small but reveal an astonishing beauty under a hand lens



(Right) A DWARF MEMBER of the numerous Spurge Family, *Euphorbia Seizannei*.

Because of the limited space they occupy, a very representative collection of the lesser succulents can be grown in a window garden

surface. This species does not produce offsets and good examples are rare. *Euphorbia meloformis* is another melon-shaped species much easier to cultivate than the above and can be increased by offsets. In *E. caput-medusae* we have a cylindric club-shaped stem from the top of which spread outwards several snake-like branches. *E. Bergeri* and *E. pseudo-medusae* also belong in this group.

6. LILY FAMILY (*Liliaceæ*). For succulent liliaceous plants we must turn to the *Aloes*, and the related *Haworthias*, *Gasterias*, and *Aprias*. Many of the first named are much too large to be considered within these limits, but at least two are worthy of special attention. These are *A. variegata* and *A. brevifolia*. *Aloe variegata* has stiff, pointed leaves spirally arranged and completely hiding the stem. These leaves are beautifully marked with transverse bands of coloring which suggest the feathers on the breast of a partridge and earn for this species the common name of Partridge Breast Aloe. *Aloe brevifolia* is a compact plant resembling a stiff *Sempervivum* and is well adapted to cultivation in a small pot.

Haworthias are all South African and are all attractive subjects. Particularly pleasing is the miniature, *H. truncata* which receives its specific name because its short leaves (which are arranged in two distinct rows) have the appearance of having been cut off squarely across their ends and what appears to be the cut section is covered with a distinct semi-transparent tissue simulating a healing wound. As a matter of fact in nature the plant is buried, so that only the tips of the leaves protrude from the ground and it is truly a windowed plant. Yet another windowed plant in this genus is *H. retusa*. This species has leaves which are smooth, erect and pale green, and the upper portion of each forms a flat transparent table. In its dry and arid home the plant is almost buried in sand and dust with the transparent surface level with the ground. Other similar species are *H. cymbiformis*, *H. asperula* and *H. mirabilis*. *Haworthia tessellata* is characterized by the fact that the upper side of the flat triangular leaves are marked with a pretty, window-pane design and it is an acquisition to any collection. Some *Haworthias* have leaves prettily marked with white or semi-transparent wart-like globules. The most desirable of these is undoubtedly *H. margaritifera*. Other members of this genus which will be sought by fanciers are *H. atroviridis*, *H. bolusii*, *H. setata*, *H. fasciata*, *H. viscosa* and *H. tortuosa*.

Closely resembling the *Haworthias* in general appear-

ance are the *Aprias*. *Aprica pentagona* is said to "look more like an artistic piece of wood carving than a living plant, it is very handsome." Other *Aprias* worth seeking are *A. foliolosa*, *A. spiralis* and *A. aspera*.

Larger and more vigorous than the *Haworthias* and *Aprias* are the *Gasterias* with their stiff dagger or sword-shaped leaves covered with stout leathery skin, and their attractive inflorescences of pink or red green-edged flowers. *Gasteria* is a large genus but a selection of the best of the smaller kinds would certainly include *G. obtusifolia*, *G. excavata*, *G. nigricans*, *G. verrucosa*, and *G. distachya*. Some species have their leaves covered with small, white granular tubercles and many are handsomely marked with pink.

7. GERANIUM FAMILY (*Geraniaceæ*). Some few of the genus to which the common red geranium belongs are succulents and are adapted for growing with other plants of this nature. The most notable is *Pelargonium tetragonum* which has curious four angled green stems and light pink flowers.

8. DAISY FAMILY (*Composite*). For examples of South African succulents of this family we turn to the genera *Kleinia*, *Senecio* and *Othonna*. Of the first named *K. galpinii*, *K. repens*, *K. tomentosa* and *K. staphyliformis* all claim attention, while among the *Senecios* perhaps the most attractive is *S. scaposus*, a species with slender pencils of leaves which are covered with a close blanket of white felt as a protection against the intensity of the sun's rays. The flowers are yellow. *Othonna crassifolia* is a neat little trailing plant with tiny sausagelike leaves of green and many small yellow daisies. It is a good subject for cultivating in a suspended basket or pot where its growths can drape themselves over the side of the receptacle in which it grows.

Because of the limited space they occupy, a very representative collection of the lesser succulents can be grown in a window garden or small greenhouse. Their modest demands for care and attention appeal to amateurs who cannot devote a great deal of time to growing plants and who must occasionally leave them over the week-ends or for longer periods without watering. In the milder portions of the country they can, of course, be grown out of doors. At the New York Botanical Garden a very good collection is on public display in the greenhouses.

Natural History for Everybody

By

DONALD CULROSS
PEATTIE

*At every season and in every climate Nature lies at your backdoor ready to make you a happier and better citizen—
IF you know what to look for*

TWELVE years ago, without a job and with a wife and little girl to support, I walked into a newspaper office and asked to be allowed to write a nature column. The editor, in a welter of next Sunday's pictures of gangsters in the morgue and dimpling society buds, told me wearily but kindly that I might try. But he'd have to kill it if, as he supposed, the response was nil.

The day came when I had to have a secretary to battle with that response. I don't attribute this to any popularity of mine, but to the popularity of nature, in which my friendly editor did not believe. The column was only a daily jotting of the things I saw that everybody might see. But when the readers began to help me write it, they showed me more than I could show them. They showed me that nature belongs to every one. That nobody hungers for it like the city dweller. That the young, believed so hedonistic, only need a little help to turn their interests into this widest and healthiest field. That the mature and the older are not too old to want to learn, and find in nature pleasures of which neither years nor adversity can deprive them. That there is a vast army of intelligent reporters abroad in the land who could assist natural science.

DONALD CULROSS PEATTIE is known to readers through a previous article that appeared recently in NATURAL HISTORY MAGAZINE and through his "Almanac for Moderns" and extensive other writings which distinguish him as one of the foremost naturalists in contemporary literature. Early in his career he was employed by the U. S. Department of Agriculture,



There is nothing that any of us can do to help a chemist or a physicist, but when biologists want to make a bird census, or study migration, or predict the next wild rodent plague, or save a forest from the saw mill, they need all the help they can get from amateurs. Many of the greatest naturalists, living and in our past, were themselves amateurs. The amateur spirit—that is, doing a thing for the love of it—is pure gold and doesn't differ from the credo of the professional naturalist, except that the latter, poor devil, gets a very low salary for performing a great many routine duties. But amateurs, holding down other jobs, whether in the office or the nursery and kitchen, keep their appointments with nature like a lover.

From amateur to expert

Remember Fabre teaching school, Audubon tending store, Alexander Wilson at his loom; their time afield was precious so they made the most of it. Audubon at last earned the right to give all his days to his great passion for birds; Fabre never got free, but left an immortal name. Men and women today, busy at their professions, are in like fashion serving this mistress who rewards devotion with a deep satisfaction. A Chicago doctor, who has only a small back yard in one of the crowded parts of the city, has become one of the foremost names in the work of bird-banding; to him, at his metropolitan station, have come bob-white and saw-whet owl, Wilson's thrush and Montana junco—ninety kinds in some five years, with a total of many hundreds of individuals. Every one of these he banded, and he found that year after year certain birds would return. Birds banded by other workers, in Canada, in South America, come to his harmless trap, and so he has assisted in mapping the mysterious sky-roads of the birds.

A New York business man, with only his Sundays in which to get away, has made a specialty of that fascinating bird, the osprey; instead of trying to know a little about everything, he decided to know everything about this one thing, so that he now ranks as an authority. A dean in Harvard law school made botany his avocation; a judge on the Massachusetts bench found that his collection of

Continued from preceding page

where he made special investigations of tropical plants. He has also specialized in the flora of Indiana sand dunes and western North Carolina. His varied experiences as scientist, journalist, and author enable him to understand the popular interest in Natural History and make him perhaps the most inspiring exponent of the deeper meaning that Nature holds for everybody.—THE EDITOR.

flowers from all over the world was eagerly consulted by scientists, and bit by bit he began himself to publish short notes and then longer articles.

For knowledge begins in curiosity. Curiosity begins in childhood, and does not always die even if long denied. The owner of a Pennsylvania coal mine who had always wanted to be a naturalist, stood resolutely by his business for 30 years; the day after he finally closed his desk he started out in the field to study the fungi. He became after he was 60 one of the authorities in mycology consulted by professionals. A doctor with an interest in reptilian life practices a dozen years in one place, and when he has learned all that there is to know about snakes and toads in that region, moves on and hangs his shingle in fresh fields; he too has a reputation. A Chicago lawyer breaks away for a week of night-life in the back woods of Louisiana where he consorts with that nocturnal prowler, the black wolf; the Academy of Sciences publishes his findings. A Manhattan advertising man has just had a brilliant success with his book of insect photography, in that unknown jungle that is the vacant lot next to yours.

The spirit of natural history

These successful amateurs each won a name. But a big reputation is not the ideal; it is an incidental award. The fame of scientific achievement comes slowly and it is not widespread. Scientists are properly suspicious of people eager to get themselves talked about. Even for amateurs science is a kind of a religion. It requires conscience and humility, and like a religion it can utilize the humblest efforts. The smallest thing well done contributes its mite to the treasury of knowledge. It is not too much to add that a love and a research of nature can mean in any life a happiness comparable with that which religion brings. If you want to find divinity in nature, you will undoubtedly perceive it there. Or if it satisfies you more to discover simply beauty or order, you will find that nature is the embodiment, and very nearly the sum total, of these things. And if it is enough for you just to find out something you did not know before, there will be no end to your fun.

For you don't have to make great discoveries or comb the world for the rare. It is enough if you enjoy yourself in the adventure of learning what is at any rate new to you. And there is no telling what you may turn up that will be new to everybody. A boy of ten who had read the greatest authority on ants in his age discovered, by watching in his own garden "the mankind of insects," things that were not in his book. He determined from that

moment to become the historian of the ants, and while also engaged in reforming the treatment of the insane and in dealing kindly with human sex problems, he made himself the greatest formicologist of his time—Auguste Forel.

So that even the most famous of naturalists necessarily began in the most complete and bottomless ignorance. Many of them were entirely self-taught. And luckily in the natural sciences anybody can be his own master. College instruction is faster than self-instruction, and it eliminates trial and error hazard, but nothing sticks like the facts you found out for yourself.

How to learn

In those twelve years of writing a nature column in the newspapers, my most appealing letters came from people who wanted to know how to learn. They hadn't had formal training or they wouldn't have been writing to me. Some were young and hunting vocations and avocations; some were older, and had at last the time to do what they wanted. Most challenging of all were those who were in the full swing of life. They heard the beguiling whistles of the birds; they glimpsed from the commuter's train window the fields filling up with wild flowers; they saw the wheeling of the unknown constellations over their suburban roofs. And they saw that human life is short; the years rush down the stream and do not return; and all about is a greater life, zestful, enchanting and deeply significant. They asked to know; they brought their minds, like thirsty cups, inquiring for the fountain.

It springs for every one, and it is found in all places. On the flat tarred gravel roofs of the city, unknown to the sleepers below, nest the night-hawks. To the puddles in an excavation for an office building in Washington, D. C., in 1928 came flocks of knots and sanderlings, ruddy turnstones and black-bellied plovers. The whole mystery of life is in the inky cloud of frogs' eggs in a ditch, and the riddle of instinct is there for any one to read in the pavement ants.

My correspondents wanted to know what to look for, and how to understand what they saw. Almost none of them had much money to spend upon technical equipment, but fortunately there is no other kind of education or hobby that requires so little outlay. They hadn't much time, but they could teach themselves much in those quarter hours that we so often devote to futile worries or to reading the parts of the paper that we don't care about.

I disagree with the logical-sounding maxim that you should study nature not books. You should study them both; a good book will unriddle nature

faster than the beginner could hope to do it. He needs beginner's books, but he will not stay with them long. As a rule, he does not have to buy the books he needs; they are in his public library, and the librarian should be asked to help. Most librarians are highly trained and unappreciated friends who are eager to make their institution useful. Probably you will soon find that some books are so good that you have to own them, but it is a mistake to let a book store hurry you into buying. With any kind of a nature book you are justified in demanding to take the book home to examine. It is better to buy a book that looks just a little hard, because you will soon have caught up with it, than to invest in one that has little to tell you.

Local manuals

The pocket guide is a fine thing for beginning field work. Its disadvantage is that it is usually so general that it doesn't tell enough about the region in which you live. Your librarian knows that your state museum or natural history survey or nearest college has published local manuals and studies that are twice as interesting and handy as anything a bookstore carries. These are either free or sell at a nominal price.

It is astonishing how every community has in it at least one person who knows a great deal about the natural sciences. The high-school teachers of

SOME BOOKS THAT WILL TELL YOU WHAT TO LOOK FOR

"BIRDS OF AMERICA"
by T. Gilbert Pearson

"FIELD BOOK OF INSECTS"
by Frank Lutz

"THE REPTILE BOOK"
by Raymond Ditmars

"AMERICAN ANIMALS"
by W. Stone and W. Cram

"THE BUTTERFLY BOOK"
by W. J. Holland

"THE SHELL BOOK"
by Julia E. Rogers

"THE STARS IN THEIR COURSES"
by Sir James Jeans

"FIELD BOOK OF AMERICAN WILD FLOWERS"
by F. S. Mathews

"FIELD BOOK OF WESTERN WILD FLOWERS"
by M. N. Armstrong and J. J. Thornber

"SOUTHERN WILD FLOWERS AND TREES"
by Alice Lounsberry

biology are often splendidly trained these days; colleges, however small, may be employing Ph. D.'s of big universities, men who carry on the inspiration of the greatest teachers. State parks, and the state and Federal foresters, can often help you to just what you need to know. It is a wonderful and inspiring thing to see how every one in this free-masonry is willing, often eager, to share his knowledge. For it is the mark of a member of it to keep nothing for himself and to get every one interested in his own field. Even two enthusiasts make a learned society. The way to find the other fellow is to ask the librarian who it is that is always keeping out the books you yourself are wanting.

Adventure at your back gate

If you live in the country, adventure begins at your back gate. Urbanites have great museums, free lectures, expeditions to join, guided by the informed. Suburbanites sometimes think they enjoy neither advantage, but in their sphere flourish the Audubon societies, and the Wild Flower Preservation societies. Or if there are none of these things in your town, why not start some? My hint for organization would be, no dues, no parliamentary rigamarole, and plenty of meetings afield. If you prefer to be a chapter of a national organization, editors, teachers, librarians know how to get you started.

But if instead of organizing, you want to start right out to be a naturalist on your own, and you wonder how to equip yourself, remember what John Muir said when asked how he prepared for an expedition. "I put a loaf of bread and a pound of tea in an old sack," said he, "and jump over the back fence."

Some people think of nature as something you can collect. Alas for the butterflies, bird's eggs, ferns and orchids! A collection as something to be studied or as a record can be precious to you; it is often the small boy's way of getting interested, and—except perhaps in the case of bird's eggs or the rarer wild-flowers—should not be discouraged. But what is called the collecting mania is not related to science, or particularly to the enjoyment of nature; the possessive craving and the urge to have something that nobody else has, break the first rules of honest science. If you are going to make a collection, remember that its future use to you or anyone else will depend on labeling every specimen with date and place, and doing your work in standard style, whether it is making an herbarium of plants or mounting bird skins. A visit to the men at the nearest college or museum will show you what you have to do.

Many beginners sweat needlessly after the rare. Rarity is just a comparative term. And in the natural sciences it doesn't mean much. As a rule, a very rare flower is merely an exceptional or unsuccessful species. Common objects have the widest and the deepest significance, and there is never any end to what one can learn about them. Instead of the rare, go after what is new to you; you get the same or a greater thrill.

There are collections you can make that museums themselves may envy. Herbaria, for instance, are overflowing with specimens of flowers; they are weak on fruits and seeds. A correlated collection is well worth while; for instance, the fruits and seeds that the local birds eat. Can you handle water colors? Paintings of the local fungi are the best way of collecting them, since they preserve so badly.

Your journal

Do you keep a "punctual almanac of the birds' first coming back"? Such records, well kept, are valuable to science. Still more valuable will your nature diary be if it records the little known autumn migrations, or the departure dates. Science is interested in taking censuses—actual counts of individual numbers. The Audubon Society now has amateur observers all over the country taking a census of birds during Christmas week, and another of nestings in June. It is on the look-out for a sudden rise or falling off in the population of rabbits, field mice, squirrels, chipmunks, tree rats. These fluctuations give other animals, including man with his daily bread, serious trouble. So that when you find a dead animal in the woods or fields, it is worth noting it down, and you should try to discover what caused its death. When there are no visible clues, the case is most interesting of all, for it usually means that starvation or disease has claimed another victim.

One could go on multiplying the useful and exciting things that the amateur, working locally, could accomplish. Nothing, for instance, has even been said about the rapid rise in importance of animal motion pictures and what the camera fan could do in this field. That doesn't mean provoking unnatural combats between wild beasts, but shots of bird and quadruped and reptile living their own private lives. By running these through slowly, scientists have discovered the answers to questions that the unaided eye could not settle.

But not picture-taking, not note-taking, not collecting nor studying books will take the place of mind and heart stored with living experience. The richest men are those who have always lived well.

Those who have traveled most widely are those who have really seen what lies about them. When we stand under the stars we can admire a remote and frosty beauty; we see a few hundred points of light scattered in the eternal constellations. But the lens of the telescope brings the nearer bodies of heaven leaping toward us. It shows us in deep and awesome perspective thousands of stars that had been buried in limitless night. So knowledge, even a little,

knowledge whether achieved through theory or practical experience, puts a new dimension into every scene. We can behold it as something more than a beautiful picture. It is peopled with friends whom we can call by name, and exciting strangers. All is fresh, all is of moment. And in this newly revealed world a man may walk, happy in the mastery that is his at the price of some curiosity, even a little effort.



DEPRESSION AND REVOLT—*The story of the last Indian uprising and its Youth Movement; how their search for "a way out" strikingly resembles the trends in our own time*

By CLARK WISSLER

*Curator of Anthropology,
American Museum of Natural History*

ONCE when the writer visited an Indian reservation in the West, the word got out that he owned a buffalo skin—one that had come down from the olden time. First a venerable man paid me a visit, asked to see and feel of the skin. The reverence and humility with which he presented himself to it were impressive. Others came and returned, to kneel before this sacred object, to touch its deep fur and not infrequently, to pray. Even the sick were brought in to sit in its presence, all of which was so moving as to make one cease to feel happy in the selfish possession of this relic of the past, so I left it in care of the chief. Even at this hour, upon many reservations, similar relics of the buffalo are carefully guarded, and many devout Indians are bowing in prayer to "Our Father, the Buffalo."

A symbol of everything good

All of which means that to the old time Plains Indian the buffalo was life itself. In our day he placed a buffalo skull upon the altar when he appealed to his tribal gods for guidance. Even then these relics of the past were rare and a white man could earn their everlasting gratitude by presenting one to them. Recently the United States Government gave small herds of buffalo to the Dakota, Crow and Blackfoot Indians. The emotional response can well be imagined, the return of the buffalo even though to a wire-fenced range is a symbol of hope that the Indian may yet find a way out.

Some of my older readers will recall their elders stalking about in magnificent buffalo-skin overcoats, remember many a childhood sleigh ride when they were snugly placed between two adults, their chin resting upon the turned-over furry edge of a great buffalo skin lap-robe. The insatiable demand for such overcoats and robes urged the white hunters on to the extinction of the buffalo. The conserva-

tionists say this was a stupid tragedy, but it was inevitable, for the rise of farms and cattle ranches is incompatible with wild buffalo herds and would have demanded their extinction ultimately.

But to the Indians, the buffalo meant meat. Good meat, too, if we may believe them, and the enthusiastic praises of the many veteran plainsmen who ate little else from preference rather than necessity. The shock that our western Indians experienced when the herds vanished, is an old story. But the suddenness of the loss is the appalling part of it. It is true that the end of the buffalo was foreseen by intelligent Indians and whites, but no one expected it to be so abrupt. We are told that even the white hunters, who the year before (1882) killed all the buffalo they could find, went confidently back to kill as many more. Where all these were to come from was not considered, the popular belief being that their number was inexhaustible. The aboriginal Indians entertained a belief that the Great God of the Buffalo kept reserve herds in an immense cave from which he would issue them in case of need. Perhaps the optimistic plainsman had somehow caught the spirit of the Indian's mythical background. The white men who formulated reservation policies and who drew up treaties for the Indians to sign knew the buffalo were doomed, but hoped to ease the Indian off to farming for a living as the herds declined. But even they failed to count on the suddenness of the event, and it upset all of their plans.

From plenty to want

The following extracts from the annual reports of Indian agents covering the short space of four years present in their factual brevity a striking picture of the course of events. For example, the agent at Fort Peck, Montana, wrote:

1881—"The Indians had a fair hunt last fall and winter, a large hunting party remaining out in the buffalo country till early January when they returned with an abundance of dried meat and plenty of good buffalo

robes which they sold to the traders at a good price. Good robes were sold to my knowledge for \$12.

"Early in July, all the Indians who had horses went across the river 30 to 100 miles southwest, where they found buffalo in abundance. A large majority of the Indians remaining out during July and August, they claimed to have killed and dressed 4500 buffalos during this hunt. . . ."

1882—"During the past year, my Indians have had a great deal of trouble finding buffalo, on account of the white hunters and foreign Indians trespassing on their hunting grounds. My Indians secured but few robes last winter and nearly all the meat they lived on was taken from the carcasses of buffalo killed by white hunters, they wanting the robe only and making very little use of the meat. The traders paid very liberally for robes the entire winter.

"In the early part of last June I called the chiefs and head men together and told them that it was necessary that all should go to hunt buffalo; that our provisions would not reach for all. They went, but many went reluctantly. . . . Some returning report the buffalo scarce and scattering; that the grass . . . is burnt off, and that there is no feed for the buffalo on their reservation; that the white hunters occupy all of the country south of the Missouri River."

1883—"Heretofore this people was expected to hunt and provide for their own subsistence for at least two-thirds of the year, the government furnishing supplies for about one-third. While the buffalo roamed in large herds over these vast plains, it was an easy matter to subsist, and, according to the Indian way of living, they lived in luxury and there was no incentive for them to work; but now the game has practically disappeared, for between the Indians and the many white hunters the buffalo are a thing of the past in this Northwest. Neither the Department nor the Indians anticipated such a sudden disappearance of the game; therefore no adequate provision has been made for their subsistence during the present fiscal year."

Starvation

That such a condition was widespread is indicated in the report of the agent at the Blackfoot reservation in Montana.

1884—"When I entered upon the duties of agent, I found the Indians in a deplorable condition. Their supplies had been limited and many of them were gradually dying of starvation. I visited a large number of their tents and cabins the second day after they had received their weekly rations. . . . All bore marks of suffering from lack of food but the little children seemed to have suffered most; they were so emaciated that it did not seem possible for them to live long; and many of them have since passed away. To feed these Indians, about 2300 in number, from April 1 to June 30 I had . . . only one and a half ounces bacon, three and a half ounces beef, and less than five ounces flour per day for each individual. I had no beans, rice, hominy, salt, nor any other articles of food except sugar, tea and coffee (of which I had only enough for the sick and infirm). . . . In the forepart of May I was reduced to such a strait that I was compelled to issue over 2000 pounds of bacon which had been condemned by a board of survey the

past winter, but which I found not to be in as bad condition as had been supposed. In the latter part of June and forepart of July, so great was their destitution that the Indians stripped the bark from the saplings that grow along the creeks and ate the inner portion to appease their gnawing hunger. The buffalo on which these people formerly subsisted is now extinct and they will be compelled to rely upon the food furnished them by the government until they can be taught to support themselves by civilized pursuits."

These reports direct from the Indian country speak for themselves, but the pressure upon spirit and emotion was even greater than upon living economy and the suspicion is that many deaths after the passing of the buffalo were due to non-material factors. For confronting the Indian was a forbidding and uninspiring outlook. No longer could he look forward to the long hunting expeditions so dear to him, but what was worse all the worthy aspirations and ambitions sanctioned by his culture were thwarted. It was not merely unemployment he faced, the economic order of his tribe collapsed. This bore hardest upon the youth. Drinking, gambling and petty intrigue were now the only outlets to self-expression. Even with enough government food to keep body and soul together, the Indian was staring ahead into an unknown void.

Many tribes affected

This great economic and spiritual depression involved far more tribes than had been caught up in the toils of any other reservation calamity. The reason is not far to seek, for the great grass land, the main range of the buffalo, stretched from Texas to Saskatchewan up in Canada. Spread out a map if you will, showing the whole of North America and note how depleted the grand old continent would look if you should cut out all the surface between the Rocky Mountains on the west, the Mississippi River on the east, and from well down into western Texas up to Saskatchewan in Canada. In all this area the most accessible and satisfactory food supply was the buffalo, and as may be expected, the economy of the many tribes residing therein was primarily adjusted to the processing (to use a new word recently coined by the Democratic party) of the buffalo. In no other part of the Indian country of the United States was there such economic uniformity—which is but another way of saying that the economy of the buffalo country was highly specialized. Hence, the sudden vanishing of the buffalo let the bottom out of everything. Under such circumstances, the Indian could see no escape ahead. There was little use in fighting the white man—he had always failed at that game. So all

he could do was hope for the return of the good old days, the economic symbol of which became a buffalo skull.

The time was now ripe for a fanatical religious movement, appealing to the persecution mania of a people bewildered by shattering reverses. Submerged racial groups have often sought a way out in an intensification of their religious folklore. Adversity has always challenged man. Sometimes he wins out. Sometimes he is overwhelmed. But psychologically, hard times prepare a people for change, making them receptive to any emotional appeal. This is seen to be true whether you go back into history to discover the roots of great religions or turn to modern Europe with its youth movements and militaristic fanaticism tantamount to religion.

Schools and the youth movement

Of course, there were optimists who saw a silver lining in the crisis among the Plains Indians. They hoped that the Indian, once bereft of his buffalo (which even to the white man symbolized the old way of Indian life), would come into the fold, so to speak, and be a more docile pupil of the schools and churches. That they were wrong cannot now be doubted. The history of all submerged people seems to fly in the face of this theory. Moreover, tangible proof to the contrary was available among the Iroquois of New York, surrounded by white people since the French and Indian War, and among the conservative villages of the Southwest where churches have stood for more than two centuries. Both these widely separated communities had their depressions but have remained pagan in thought and worship to this day. But let it not be supposed that the missionary attempts to educate these Indians were wholly unsuccessful. Many times in the Indian country we heard thoughtless, contemptuous remarks flung at the efforts of missionaries and government schools. These critics forgot that many young Indians left school able to speak and write English, that in the large boarding schools, young people from many tribes were thrown together, that they had to learn English if they wanted to talk at all, that lasting friendships were thus formed which resulted in their writing letters after returning to their respective reservations. In short, that a groundwork of common ties and language was laid in these schools for the development of a widespread youth movement that could never have been possible without the unwitting aid of white teachers and missionaries. Tribes formerly hostile were now caught up in a network of friendships.

The religious "revolution" was coming and these educated youths were to be its main protagonists. It is interesting to note in this connection that youth has almost always been the vanguard of such uprisings whether in primitive cultures or in modern. It is a commonplace saying that irrational fanaticism is essential to every popular revolt, anyhow fanatics of a peculiarly Indian sort were soon to appear upon the scene. The Indian had for long been a believer in the super-human. His own helplessness in the face of Nature was ever apparent to him, and just because so many situations in life mysteriously balked his individual efforts whereas others succeeded, he put his faith more and more in the good or ill wishes of the unseen. Such a power could not be tricked into helping him, but it could be humane. And if ever the buffalo Indian needed the help of the gods, it was at this hour. So the religious Ghost Dance craze, which is the white man's name for the movement, came into a perfect psychological setting.

Visions and trances

As to how the thing actually started there are several opinions, but for us it is enough to know that the real trouble began among the Dakota Indians where many were far from being reconciled to a future of gloom and servile defeat. There was still a powerful craving for buffalo meat, an extinguishable longing for the beloved hunting expeditions in pursuit of the wild herds. Certain young men in particular revolted at the idea that the order of the world had changed, or that the gods of their fathers had deserted them for good. One or two of these ardent mystics received signs in their dreams which strengthened their faith that supernatural power was sympathetic to their cause. Then at just the right moment came the fanatic. Strange tales were heard of a great seer in the West who could, when in a trance, talk to the long dead and to the great unseen, handing down prophecies. Like the fabled wise men of old, these youths were drawn thither by they knew not what. The trances of this seer were impressive, he professed to see the buffalo again roaming the grassland and no white men in sight. When they returned home, the erstwhile pilgrims started agitating, many men and women soon found that by dancing and singing they too could go into trances and have visions of the past when the buffalo was king.

For generation after generation, all Indians had believed that the road to higher truth and power was to be sought in dreams and visions thus there was nothing essentially new in the Ghost Dance

religion, it was the old belief cast in a new form and it seemed the one way out. Converts were made and vied with each other in having new visions. And as the frenzy grew, more and more emphasis in these visions was placed on the sweeping of the white race from the land. Naturally to get the buffalo back farms and ranches would be destroyed to make room for them.

White man's language a bond

The rapid spread of the Ghost Dance religion was largely because many of the younger Indians, educated in government boarding schools, had classmates among most of the buffalo Indians, and they not only had a feeling of friendship for each other but possessed a common knowledge of English, which even though the language of the hated white man, was of necessity used to plot against him. We say of necessity, because something more than twenty different languages were spoken by the buffalo hunting tribes. So in this time of acute unrest letters in English were passing back and forth from Montana to Texas, spreading the spirit of the new religion, and pleading for a revolt against white civilization. Really it was a changed world, the Indian preparing for revolt, using the fruits of his new education to marshal his strength in an effort to sweep the hated white race and its civilization back into the Atlantic Ocean. But since this underground language was English, secrecy was impossible. It was, in fact, a mixed-blood postmaster who first revealed the widespread agitation for revolt. He was unintentionally a kind of spy, learning of the revolt because some of the letters fell into the hands of uneducated Indians who asked him to interpret them. Then as things were coming to a head the Indian agent at Pine Ridge, South Dakota, in his annual report for 1890 called attention to a blunder of the Government which became a decisive motivating factor.

During the previous year, a government commission had signed an agreement with the Indians on his reservation by which they were to receive a liberal allowance of fresh beef. A majority of the Indians accepted this agreement in good faith and affixed their signatures to the documents. Later the agent was surprised to learn that the amount of beef promised had been reduced by one million pounds which meant that they would receive four instead of five million as called for in the agreement. All appeals to Washington were in vain, and accordingly the Indians not only lost all faith in the promises of the Government but, excited as they

were, interpreted this action as the beginning of an attempt to starve them out.

In the same report, the agent makes the following interesting comment:

"During the early spring a report reached these Indians that a great medicine man had appeared in the Wind River county in Wyoming, whose mission was to resurrect and rehabilitate all the departed heroes of the tribe and restore to these people in greater abundance than ever before known such herds of buffalo and other wild game as would make them entirely independent of aid from the whites, and that such confusion would be brought among their enemies that they would flee from the country leaving them in undisputed possession of the entire northwest for all time to come. Strange as it may seem, this story was believed by a large number of Indians and is this day. An Indian belonging to the Cheyenne River Agency who had lately visited the land where the new Christ is supposed to be sojourning temporarily came to this agency a few weeks since and before I learned of his presence, he had succeeded in exciting the Indians living upon Wounded Knee Creek to such a pitch that many of them swooned away during the performance of the ceremonies which attends the recital of the wondrous things soon to come to pass, and one of the men died from the effects of the excitement. On Friday, 22d instant, about two thousand Indians gathered on White Clay Creek about 18 miles north of the agency to hold what they call a religious dance connected with the appearance of this wonderful being. Noticing the demoralizing effect of these meetings I instructed the police to order the gathering to disperse, but found the police were unable to do anything with them. I visited the locality where the Indians had assembled on Sunday, the 24th instant, accompanied by twenty of the police. The Indians probably heard of our coming for they had dispersed before we arrived at the grounds, several of the bucks, however, were standing around in the neighborhood of where the dance had been held. These men were stripped for fight, having removed their leggings and such other superfluous apparel as is usually worn by them and stood with Winchesters in their hands and good storing of cartridges belted around their waists prepared to do or die in defense of the new faith. They were quieted after a time by being made to understand that we had no desire to harm them but had come to order the people to their homes, who, it had been reported, were gathered here in violation of orders. While nothing serious may result from this new religion, as it is called by the Indians, I would greatly fear the consequences should there be no restriction placed upon it."

"Bullet-proof" shirts

Naturally government agents were alarmed over the savage enthusiasm and vague remarks as to the expected obliteration of the white race. Coming together in large camps the converts spent most of the time dancing and listening to the preachings of their leaders. Presently no secret was made of the part the Indian was to play, he was to be the chief avenger and the powers above were to see to it that

the bullets of the whites were harmless. Certain thin cloth shirts were made and painted with mystic emblems, the leaders asserting that these would be bullet-proof on that great occasion. Agitators were sent to all the reservations, north and south, even to the hereditary enemies of the Dakotas. Naturally there was skepticism and suspicion, but here and there converts were made. Most of them were intrigued by the idea of a comeback—to that at least, all were sympathetic.

These activities coupled with the discovery of the underground letter writing soon made many agents uneasy. Calls for troops piled up in Washington, newspapers over the west were vocal as to the danger of a new Indian war, demanding that quick action be taken to stop this fanatic movement. The agents on marginal reservations pleaded with their Indians to have nothing to do with the movement, since a war could but end in their own destruction. Things went from bad to worse, troops were concentrated at strategic points and General Nelson A. Miles, placed in command. According to his plan, the authority of the agents was to be supported everywhere, they were to remain at their posts, regardless, and to their honor they did, give them credit for that. It was soon guessed that the first break would come at Pine Ridge Reservation, the center of the movement, and a prompt concentration of troops was made to prevent these Indians from leaving the reservation. And such was the show of strength that the Ghost Dancers could do little harm at home.

A hopeless cause

As in the fights with General Wayne at Fallen Timbers, with Harrison at Tippecanoe, etc., the Indians now faced an army well equipped and what is more, provided with new machinery in the way of rapid-fire light artillery. Their case was hopeless from the start. Further, the main body of their own people held back. For one thing, the new religion had left them cold, especially the old and experienced. Lacking faith in these new teachings because not sure they were genuine, they preferred to play safe. The final outcome everyone knows; some blood was shed, but the Indians were soon disarmed and forgiven. Yet the religious movement did not really die, but continued for many years as a form of worship and an outlet to the emotions of a limited number. The most fanatical of the hostile group at Pine Ridge drew apart, kept away from the agency and still form the most conservative community in the region.

A visit to the reservation a few years later, found none of the participants willing to talk about the affair. Though forgiven, they were still marked men, but on two subjects they were vocal. One of these was the greatness of General Miles. They looked upon him as everything a soldier should be, some declaring him the only worthwhile white man they had heard about. Those who cherished personal contact with him were even more vocal in his praise. One of the favorite examples of his manhood was in substance, that in the Wounded Knee fight, an Indian took an army rifle from a soldier. After the final surrender, when the arms were being given up, this Indian insisted upon seeing General Miles in person, to whom he presented the rifle with a statement of how he took it in a life or death struggle in which he killed the soldier. General Miles returned him the rifle, remarking that war is war, that the victor came by it honorably, but now there was peace, etc., upon which they shook hands. The incident may not have happened, but the Indians believed it did and it was in keeping with their high regard for the man.

"Black buffalos"

The second subject of which they seemed never to tire was the colored cavalry. Somehow they had neither seen nor heard of colored troops, but one day a regiment of colored cavalry rode into the agency. The day was hot so the troopers took off their shirts and began sponging down their mounts. At that moment word came that the hostile Indians had ambushed a patrol in an arroyo a few miles out. The regiment were ordered out instantly. The Indians met with a surprise when these black fellows rushed down upon them nude to the belt, riding horses barebacked, yelling like madmen as they charged. It must have been the unexpected, unconventional, noisy way of fighting that impressed these Indians. It was soon apparent that these troopers were in a fair way to become heroes in a myth—"black buffalos" they were called, probably because their hair was woolly and their skins black. Of course, the Indians had seen negroes before, it was their unexpected and unconventional behavior as soldiers that made them famous.

Grass soon grew upon the graves of those who fell victims to the suppression of the Ghost Dance uprising, and as the years passed few Indians seemed to think of these dead and their cause. But one thing remained ineffaceable in their memory. They could not forget the buffalo.

HOW OLD IS A GEM?—*Ageless, intrinsically; but the gem-cutter leaves the hall marks of his period and country as clues to what queen the jewel adorned*

By HERBERT P. WHITLOCK

*Curator of Mineral and Gems,
American Museum*

WHEN we read in the Rig Veda the fascinating myth that recounts the birth of the sapphire, the legend begins "Five thousand Kalpas ago." Now a Kalpa means a day of Brahma, or more specifically the length of time from a creation to a destruction of the world, so that five thousand Kalpas represent a totally incalculable period of time, something so fantastically ancient as to be beyond the power of our western imaginations. And this seems to be singularly appropriate as applied to a gem which like any other mineral, has no age.

A ruby or sapphire lies hidden in the rock that has been its home since that rock was born from the melting pot of a nascent planet eons ago. Throughout its travels as a pebble, worn away from the rock by erosion and carried along down the hillside by some stream, it continues to be a ruby or sapphire and nothing else; and even when the hand of man has recovered it and converted it into a glowing scrap of adornment it still holds its identity inviolate, and is never used by man for anything but a jewel.

But, although we cannot with certainty compute the age of a gem from the time of its formation, we can in very many instances count back to the *last* time when it was cut. We say "the last time" advisedly, because gems, as they are handed down from generation to generation of gem wearers, are recut many times.

And it is this latest cutting that actually gives us a date back to which we may compute a relative age

for a given gem. In this way we are able to say that a certain diamond was cut before the beginning of the eighteenth century, or at some time during the reign of Victoria, as the case might be. It is sometimes possible to date a gem setting, within fairly reasonable limits, by observing the way in which the diamonds that surround it are cut. As an example the diamonds that compose the famous Napoleonic necklace, which was the gift of the Emperor to Marie Louise, are mostly cut as deep brilliants, a style of cutting in vogue in the eighteenth century, but which was supplanted in the early years of the nineteenth century by the Old Mine Brilliant of Victorian time. As we would expect, there are a few Old Mine brilliants scattered among the older cuttings in the Napoleonic relic.

Sometimes the stones set in an ancient piece of jewelry have obviously been cut at a time that antedates their setting, as is the case with the sapphires cut and drilled to be used as strung beads, which are set in the gold crowns of the seventh century Visigothic Kings. These famous crowns were found near Toledo and are now in the Cluny Museum in Paris. This custom of using necklace beads of much older date in later jewelry forms is by no means confined to crowns of the medieval Spanish Kings. The Royal Crown of Bohemia, known as the Crown of Saint Venceslas ("Good King Wenceslaus" of the English Christmas carol), which was made in the fourteenth century, is set with rubies, sapphires and emeralds, the sapphires having been necklace beads taken from an earlier assemblage.

The matter of gem stones mounted in rings, when considered in the light of "period" cuttings, is a particularly fascinating side issue. There are in-

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the human interest in precious stones and has been interpreting their lore for the past thirty-five years to an interested public. His most recent book, *The Story of Gems*, is already well known as a fascinating introduction

for the layman and a valuable home reference book. For many years he has been custodian of the Morgan Collection of Gems and Curator of Minerals and Gems at the American Museum of Natural History.—THE EDITOR.

stance the memorial rings of the late eighteenth century which carried in their bezels fragments of hair from the head of the deceased, often woven into intricate patterns. To protect these designs in hair, usually thin panes of glass covered them, but in rare instances, the covering bezels were thin cleavage slabs of diamond. Personally, I have never had the good fortune to see one of these rings with its tiny window glazed with diamond, but others have assured me that such rings are still in existence, bearing silent witness of an era when ladies' hands were far more ornamental than useful.

French betrothal rings of the late seventeenth and eighteenth centuries were sometimes set with heart-shaped rose cut diamonds, either singly or in

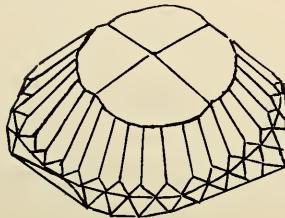


Figure 1. The original cutting of the famous Koh-i-nur (above) illustrates the tradition in India of preserving the greatest possible weight in the finished stone. The Koh-i-nur was recut in 1852

pairs, the unusual girdle outline coupled with the rose cutting operating to confine the period of these stones to relatively close limits.

Still stranger to the novice than the dating of types of gem cuttings are the slight variations in these cuttings by which one is able to determine the place where the stone was cut. Of course, in bringing this matter into the category of "gem hall marks" we are purposely omitting such obvious examples as the engraved cylinders of Babylonia, Assyria and Persia or the scarabs of Egypt.

Perhaps the most characteristic example of the way in which lapidaries of a certain country or city lend individuality to the gems that they cut is the case of the East Indian gem cutters of India, Ceylon, Burma and Siam. For the most part seated on the ground in bazaars, and furnished with the most primitive of tools, these artisans cover the stones upon which they work with a multitude of facets, distributed with no regard for symmetrical arrangement or for brilliancy-efficiency in the manner of their placing.

Indeed East Indian gem cutters are activated by

the endeavor to leave the greatest possible weight in the finished stone and to so dispose the facets as to conceal whatever flaws may be present. The tradition of this policy goes back to the time when dia-

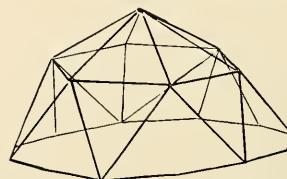


Figure 2. The Holland or Dutch Rose, a cutting invented during the reign of Louis XIV and followed in Amsterdam for a century or more

monds were cut in India, and by native craftsmen, and a very famous example of it was the original cutting of the Koh-i-nur, one of the best known diamonds of the world. Just when the Koh-i-nur was cut and for whom is not known. No doubt it had a long and colorful history before its first authenticated appearance, when in the beginning of the fourteenth century it formed part of the spoils of war in the conquest of a small native Hindoo Kingdom by a predatory neighbor. At that time it was cut as shown in Figure 1, and had been an heirloom of the Rajah of Malwa for very many years.

Since that time the Koh-i-nur has figured in practically every change in dynasty in India, always becoming the property of the conqueror. It became a veritable stone of destiny, and for four centuries the hand that has held the Koh-i-nur has ruled India, until it has finally become the property of Victoria and succeeding Queens of England.

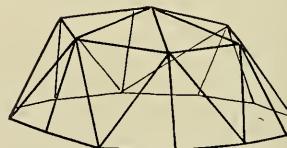


Figure 3. The Brabant Rose, a 17th-century style devised by the Antwerp cutters in competition with those of Amsterdam in which a much lower set of crown facets is featured. For brilliancy this cut is less effective than the Holland Rose

The recutting of this ancient and historic stone to conform to the questionable taste of a later generation seems little short of vandalism, and by what would seem a fateful stroke of poetic justice, five

years after the' Koh-i-nûr was recut Britain nearly lost India through the Sepoy Revolt in 1857.

It is indeed a far cry from the dim, legendary days of ancient India when some craftsman whose name

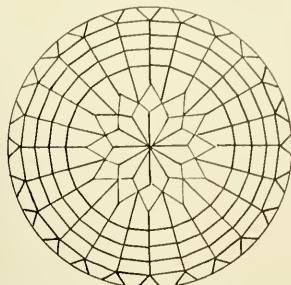


Figure 4. The Scottish or Edinburgh cut, showing a characteristic method of reducing the number of step facets toward the center or lowest point of the stone. Studied from a cairngorm or smoky quartz, weighing 2015 carats and cut with 313 facets

has long been forgotten gave to the Koh-i-nûr its memorable grouping of facets, to France in the seventeenth century and the brilliant court of "le Roi Soleil". During the reign of Louis XIV, a style of diamond cutting was invented called the "rose cut," and said to have originated in the fertile brain of Cardinal Mazarin. The famous ecclesiastic who cer-

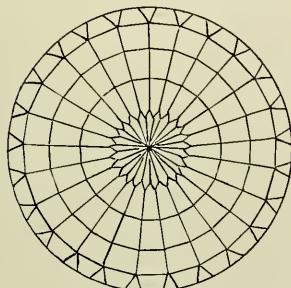


Figure 5. A variation of the Scottish method of decreasing the number of facets toward the point. From a cairngorm weighing 829 carats and cut with 301 facets

tainly did not confine his interest to things spiritual, caused twelve of the diamonds of the French crown jewels to be recut in this form, and these were known as the "Twelve Mazarins." This recutting

was executed in Amsterdam, the center then, as now, of diamond cutting in Europe, and the newly invented form of cutting for a century or more, was popular in France. The Holland Rose, or, as it is sometimes termed, the Dutch rose, is shown in outline in Figure 2. At that time Antwerp was attempting to wrest from Amsterdam the prestige of being Europe's foremost center of diamond cutting, and in consequence, devised a modification of the Holland Rose, with a much lower set of crown facets which was named the Brabant Rose. The Antwerp variation of the rose cutting is shown in outline in Figure 3. Although this latter cutting was not especially successful as applied to diamonds, it still continued to be used among the Antwerp cutters, and many of the old diamonds set in seventeenth-century French ring mounts have this form.

A short time ago my attention was called to a group

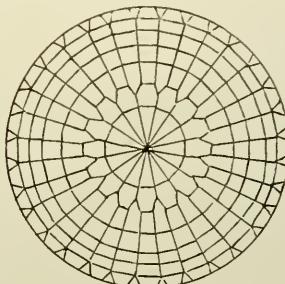
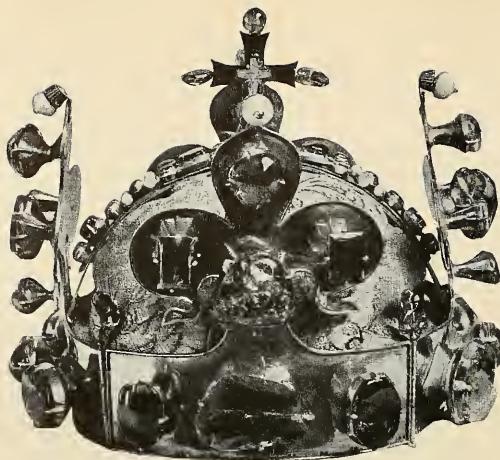


Figure 6. In the 656-carat Scottish cairngorm shown above, variety was achieved by making alternate facets five-sided in the next to last ring, but the significant Scottish character was preserved

of seven large quartz gems, of rock crystal cairngorm, citrine and Spanish topaz which had without question been cut in Edinburgh. As is usual with large stones of this kind, these were made with a great multiplicity of facets, the pavilion, that is the part of the gem lying below the girdle, or greatest breadth, being given a variation of a step cut. The point that struck me as odd was that the five or six encircling rings of step facets, each made with some sixteen to twenty-four units, were, for the last two rows that terminated the pavilion, reduced to half that number by cutting the facets just before the change in their number with pointed instead of square ends.

I compared several large cairngorms in the Morgan Collection with these unusual step cut stones and found the same odd character in the make of at least three of them. This has led me to believe that



A RUBY OR SAPPHIRE is as old as the earth itself, having been born from the melting pot of a nascent planet eons ago. But the date of its cutting can often be determined from the "hall marks" the cutter leaves of his period and country

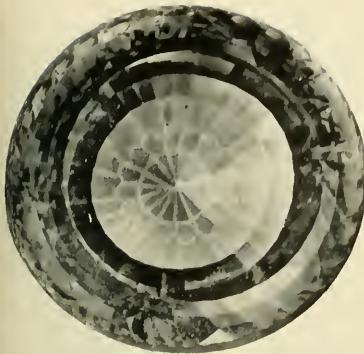
Thus, though the royal crown of Bohemia (*above*) was made in 1346, its ancient jewels are known to be much older. They are dedicated to the Bohemian national saint (the "Good King Wenceslaus"), whence it derives its name, The Crown of Saint Venceslas



(*Above*) To the practiced eye the typical 19th century Russian style of deep groove cutting is apparent in this rock crystal seal, carved in the Royal Lapidary works in Ekaterinburg. It is here reproduced approximately $\frac{1}{2}$ actual size



(*Above*) A second, less ornate rock crystal seal of the grooved Russian style, illustrating that "hall marks" are observable in semi-precious stones. (Approximately full size)



A TYPICALLY SCOTTISH style of cutting is observed in the cairngorm or smoky quartz shown above. Its telltale hall mark is the manner in which the number of converging rows of facets decreases toward the center



APPLICATION of the Russian groove technique to gems, as illustrated above by two large rock crystal brilliants, was a natural transition for craftsmen long used to carving grooves in paper weights, umbrella handles, and seals like those opposite



RUSSIAN CRAFTSMANSHIP on a Turkish signet is clearly indicated in the rock crystal seal of the Sultan Abdul-Medjid of Turkey shown above as viewed from the side and bottom

EARLY NINETEENTH CENTURY craftsmanship is detected in the necklace given by Napoleon I to Marie Louise in the second decade of that century. Most of the stones are deep-cut brilliants, in vogue in the seventeen hundreds, but a few of them are Old Mine Brilliants, a favorite style of the Victorian period



such gems, cut in Scotland have a characteristic make that sets them apart as *Scottish or Edinburgh cut* stones. In three figures on the preceding page I have given outlines studied from these typical Scottish gems with some of the variations. In Figure 5 it was evidently not considered essential to reduce the number of facets in the last ring, but variety was achieved by "staggering" them and making the facets immediately above five-sided and symmetrical. However the significant Scottish character of the treatment is preserved.

In the variation shown in outline in Figure 6, reduction in the number of facets in the final rings is arrived at by making alternate facets five-sided and symmetrical thus closing the alternate series of steps whereas the remaining series run through to the point.

In the nineteenth century there grew up in Russia a very characteristic glyptic art, inspired to a large degree by the formalism of Victorian Europe, and having its seat at the Imperial Lapidary Works at Ekaterinburg. Here a group of craftsmen, working in typically Russian ornamental stones, such as rock crystal, jasper, rhodonite and malachite, turned out a multitude of such small carved objects as appealed to the taste of cultured people of that era. And, because these lapidaries were essentially gem engravers, rather than cutters of faceted stones, the paper weights,

seals and "mantle ornaments" that they produced were decorated with grooved and channeled motives which were easily explainable when we consider the technique of these artists. So characteristic is this style that it may be recognized without the least trouble by anyone who has seen even a few examples of it. It is, in fact, distinctly Russian.

It is easy to understand that a lapidary accustomed to carve grooves in vases and umbrella handles should also introduce the "channeled technique" into his work in large faceted rock crystal pieces such as those illustrated on page 117. As will be seen from the illustrations these Russian faceted stones give back a multitude of odd reflections impossible of achievement under a system of ordinary facetting.

As with all examples of the Ekaterinburg lapidary work, the small rock crystal seals, of which a very typical example is shown among the group of illustrations on page 116, are definitely in character. And so, when about a year ago, the Morgan Gem Collection received from Mrs. George Bowen deLong, the important gift of a rock crystal seal, which had belonged to the Sultan Abd-ul-Medjid, and which was engraved with his signet, we could add to its label "carved in Russia."

Thus we arrive at the apparent paradox that gem hall marks are not always confined to gems, if we interpret these latter as "minerals of adornment."

APPLICATION FOR MEMBERSHIP
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Please present my name to the Membership Committee for election as an Associate Member and find enclosed \$3.00 covering dues for the next twelve months.

I understand that I am to receive NATURAL HISTORY MAGAZINE each month except during July and August, my members' card for admittance to the members room, my certificate of membership showing the date of my election.

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THE AMERICAN MUSEUM reserves the right to reject any application

IF YOU DIED IN OLD PERU—Recent examination of a prehistoric mummy bundle shows that it would have taken you a year to complete the four-stage heavenly journey symbolized by four separate ceremonial burials

“I AM afraid, gentleman, that I am an unconscionable time a-dying,” Charles II may have been justified in making this celebrated remark on his death bed; but it would have been a statement with which we could more heartily agree had it been handed down to us (through some curious anachronism) by a king in prehistoric Peru. For on the Peruvian peninsula of Paracas long before the days of Columbus, preparations for the death of a potentate might well be said to have begun almost on the day he was born.

Social caste

Class distinction had its place in this ancient society that flourished at about the time the “barbarians” on the other side of the world were putting the final touches on the fall of Rome; and the distinguishing feature of the man of wealth and power seems to have been the peculiar way in which his head bulged out in the back—a disfigurement in the name of social caste which was effected by binding the head. This rite initiated the future chief, so to speak, into society. But this was not the last time that special rites would be accorded his person, for his people believed in a very real and complicated after life. From the time he first began to notice the difference between his head and those of the “commoners” and to observe the funeral custom of his people, he knew that when he died an elaborate rite would usher him out of this life and on the long journey.

Preparations for the journey comprised four stages, symbolized by four successive ceremonies, ornate and of great solemnity, which were probably spread over an entire year. He would be buried, of course, but not just once. The four stages of the journey to the Valhalla of his ancestors required that he be disinterred thrice and be buried four times.

We are fortunately able to reconstruct this ancient scene from grave materials discovered by Dr. Julio C. Tello and studied by Dr. W. C. Bennett of the American Museum of Natural History.

Just as in our mother's youth a girl spent much of her time accumulating a hope chest, the Paracas chief, from childhood, accumulated the symbols of wealth in preparation for his year-long funeral. For, the wealthier the man, the more lavish his funeral, and presumably the easier his heavenly journey. Great wealth as measured in that society meant the possession of large quantities of remarkably embroidered cloth. By growing their native cotton and by trading for llama wool with the pastoral mountain-dwellers farther inland, the basic materials were available for one of the greatest textile industries both in volume of production and in decorative variety that had ever been achieved in the Western Hemisphere up to that time. And the products of their looms, even as they had been used as head bindings for the child, would be wound in far greater quantity and far richer design around the chief's mummy.

No matter what the organic cause of death, a man of that time was able to foretell the manner of his progress to heaven, because he had seen and participated in the gorgeous funerals of his relatives and immediate ancestors. The procedure was something like this:

Sixty layers of clothing

For a time the body of the late chief or medicine man was left lying in state surrounded by his material possessions, many of which were intricately decorated poncho shirts, shawls and other wearing apparel especially woven for the long journey to heaven. These garments were distinguishable from those worn in everyday existence. Possibly the chief was expected to increase in size in the course of his journey, for some of the shirts measured 50 by 38 inches with a 28-inch braided fringe at each shoulder and a 20-inch flat fringe along the borders. Shawls were often as large as nine by five feet with eight-inch embroidered borders. Before the long drawn out process of burial was completed, as many as 60 layers of assorted fabrics, perhaps more if the



WHEN 429 MUMMY BUNDLES were unearthed from an ancient burial site on the coastal peninsula of Paracas, Peru, archaeologists were provided with highly significant clues which are expected to lead to the reconstruction of a civilization unrecorded in written history. Several of these mummy bundles were examined by Museum archaeologists

and a display of their findings is now on view in The American Museum of Natural History. Above, Assistant Curator of Anthropology Wendell C. Bennett is shown scrutinizing the completely desiccated head of one 1500-year-old mummy before stripping off the 20th century burlap sacking containing the bundled figure of another



SIXTY LAYERS of remarkably woven, intricately decorated shirts and shawls were wound around the mummy in concentric circles. The outside wrapping shown above resembles plain cotton duck cloth. The mummy had four such windings, one for each of four separate burials



(Above) PARTIALLY UNWRAPPED, the bundle began to disclose small objects recognizable as corn, chile peppers, and peanuts. Since such non-perishable foods were carried on earthly trips, realistic belief in a hereafter demanded that they be packed with the mummy on his journey to heaven

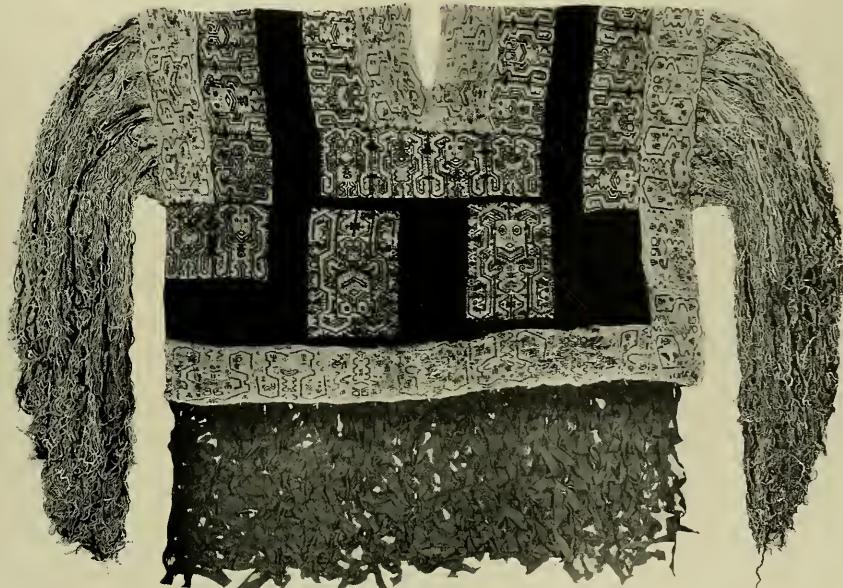
(Below) HIS FACE WARPED by the ages and the cotton turban foundation ludicrously askew, this ancient potentate's head is nevertheless of great value to science. In preparing the mummy's head, the prehistoric Peruvians were evidently at great pains to prevent the spirit of the dead from returning, for they stopped up its nostrils, ears and mouth with cotton, and sewed its lips together

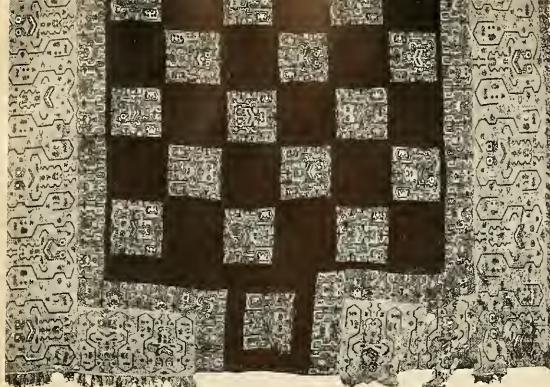
(Below) THE LIMBS AND TORSO shown in much the same flexed position as that arranged at death. Traces of blue dye found on the skin though probably of ritualistic significance, had nothing to do with preservation. Although some authorities believe the body fluids were drawn and some preservative added, all agree that Paracan embalming methods were far more primitive than those of ancient Egypt



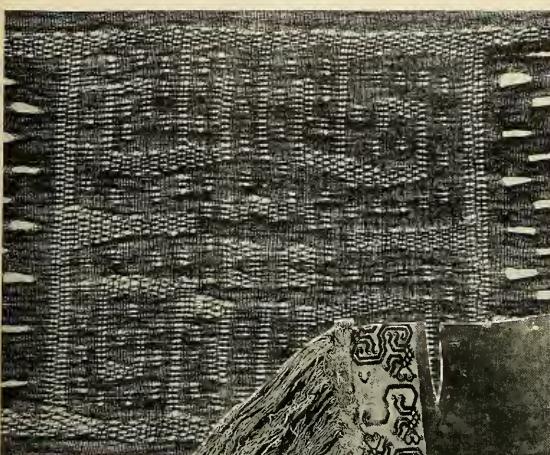
(Below) APPARENTLY FORM-FITTED FOR A GIANT, this skillfully decorated poncho shirt was one of the many garments included in the mummy bundle as raiment for the heavenly journey. Conceivably the dead man was supposed to have increased in stature as he approached the celestial gates, at any rate the shirt measures 50 by 38 inches, with a 28-inch

braided fringe at each shoulder and a 20-inch flat fringe along the borders. Clothing of this non-utilitarian type was probably accumulated during life in preparation for the protracted funeral, much as "hope chests" were carefully amassed by young girls in our mothers' time

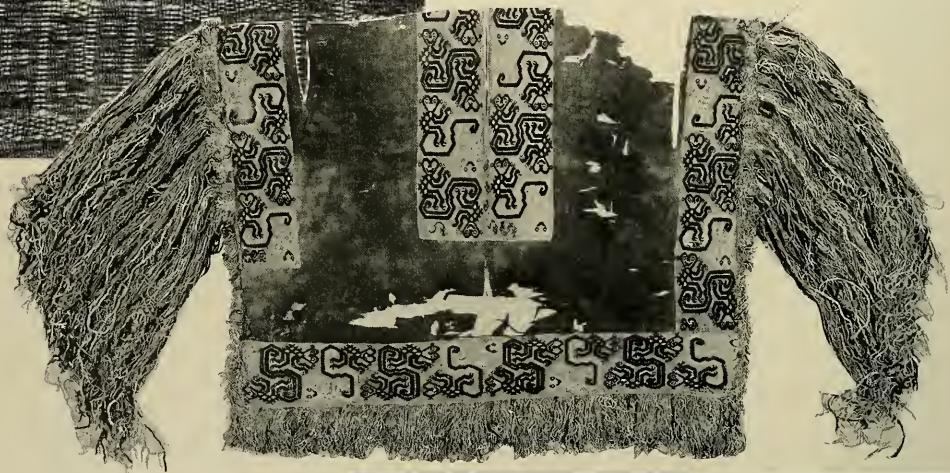




(Left) THIS BEAUTIFUL SHAWL attests the high degree of decorative craftsmanship achieved by this ancient people. The checkerboard of embroidered designs are embellished by the stylized figure of a cat in red, yellow, blue and green on a blue cotton base cloth. The repetition of this cat design both in embroidery and other art forms indicates that this animal had mythological significance



(Left below) THAT THIS FRAGILE GAUZE PANEL did not disintegrate during its 1500 year interment is due to the extreme aridity of the Paracas climate. The figure of the cat again appears woven into its transparent structure. Authorities consider this specimen and others like it to be supreme examples of a primitive weaving art



(Below) A SMALLER AND NOT QUITE SO WELL PRESERVED poncho shirt with border strips of polychrome embroidery showing interlocked animal designs

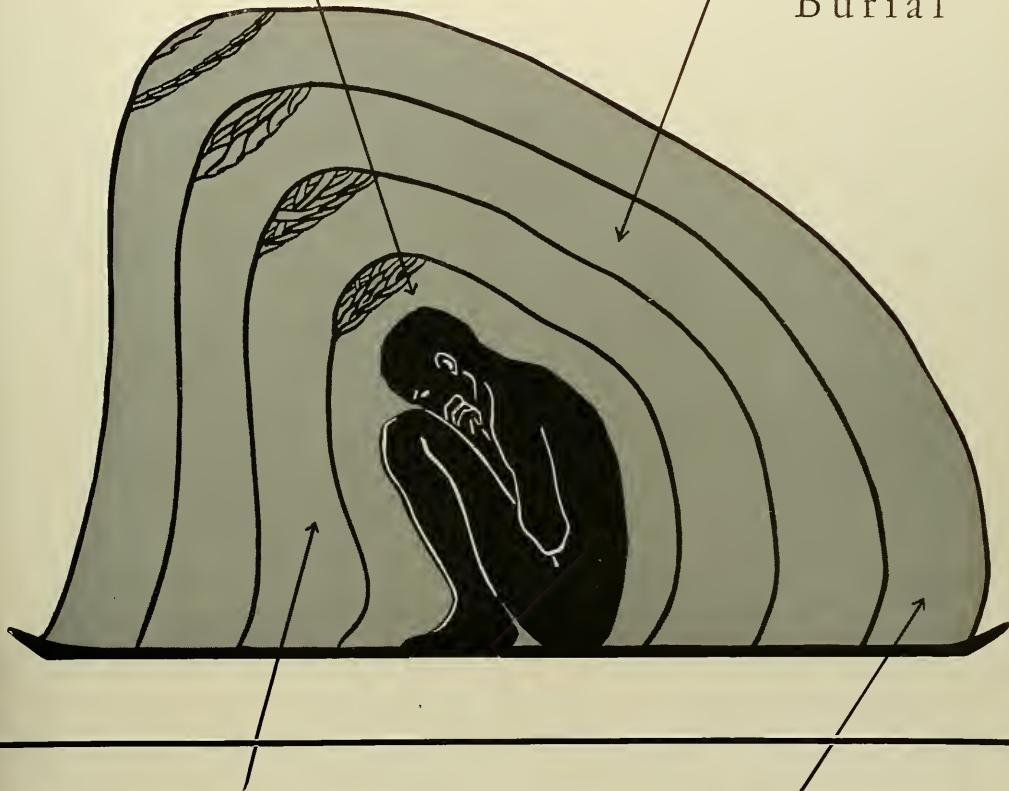
(Right) FUNERAL ORNAMENTS cut out of hammered gold sheet, that were found in one of the mummy bundles. Archaeologists take the airplane-like objects to be fish, and explain the little bibelot at top center as a man holding a spear-thrower and darts. The other decorative figures near the seven-pointed geometric figures are simple bands which were worn as bracelets and a small gold flake discovered in one of the mummy's nostrils



STAGE I. After the chief's body had been prepared in a flexed position in the center of a shallow palm fibre basket, various ornaments and foods were placed on or near his person. The following clothes were then bundled around him to form the first layer: a tanned skin and cloth decorated with yellow feathers, three plain brown cotton shirts and two brown skirts; the head was bound with a plaited band decorated with a top-knot of feathers, covered with a square cotton cloth and a turban, and finally draped with a yellow feathered cloth. The body of the chief was then wrapped in a coarse cotton cloth, and the whole, including the head, bound in a plain cotton wrapping, very much like modern white duck cloth.

STAGE III. This is the point at which the entire bundle reaches a size almost double that of the original mummy. There were eight shirts, six shawls, twelve folded pieces of cloth used as padding, two layers of striped cloth wrapping, more shawls and shirts, both placed over the bundle in the usual way and folded alongside to pad it out—the whole bound with narrow bast fibre. The head was padded with plain brown cloth and the usual turban was perched on top, then the entire bundle was wrapped in the coarse cotton cloth which in this stage had been pulled in upon itself and bunched to form an even larger false head, by this time, far above the chief's actual head.

The Four Stages of an Ancient Burial



STAGE II. Over the original mummy-bundle the following were added: six plain brown layers of cloth, three shirts, four shawls; the head was padded with a shirt to augment the bump made by it in the bundle, and was bound with two turbans. Once more the whole bundle was covered with coarse cotton wrapping. This plain cotton wrapping may be regarded as the dividing line between each of the four stages, since the same material was used with each re-decoration of the mummy-bundle.

STAGE IV. The final stage approximates the first, in that ceremonial objects and decorations were again added—a tuft of feathers on a stick and a yellow feather fan. Besides these were the usual shawls and a feather-tasseled turban—all enclosed in a final white cotton wrapping, seamed and sewed together. This outer aspect of the bundle was what the excavators saw when they found the old chief and disturbed his centuries-old slumber.

chief were exceedingly wealthy, might be included in the bundle. His would be a luxurious journey to the land of his fathers. But before the bundling began, the body itself was prepared for the tomb.

Certainly these people possessed no such intricate embalming process as that employed by the ancient Egyptians, and details of the preparation are obscure. But many believe that the body fluids were extracted in some manner and it is possible that some sort of preservative was spread over the body. However, that may be, the chief's skin was painted with bands of a blue vegetable dye.

When the painting was completed, the body was placed in a flexed position with the hands carefully folded on the chest. The knees were then drawn up almost to the chin and bound together with vine cords. This hunched-up position is interesting to consider. It cannot be explained on the grounds that this was merely the easiest way to bury the body, because the elaborate attendant ceremonies and the time and effort involved in the four-stage ritual was far from simple. One possible explanation might be this: Far back in the early days of this culture before the people had come down from the hills onto the coastal peninsula, burial grounds were dug in rocky, unyielding ground. In this environment, the difficulty of grave-digging led to the custom of binding the body in a flexed position to make it fit in the smallest possible space. As time went on the custom probably received some sort of apotheosis and remained a sanctified ritual long after the actual need for it had passed. Other speculations quite as credible might be brought forth, but the fact remains that the body of our hypothetical chief was arranged in this flexed position and placed in a large shallow basket woven of palm fibers. The fingers were tied with cotton string and simple gold bands were fastened around the wrists. Then began the ornamentation of the body. Around the neck was placed a string of shell beads ending in a cut-out gold pendant. Figures of fish fashioned of thin hammered gold and attached to short sticks were placed by each knee. It has been suggested that these latter figures, because of their recurrence in various graves, represented a minor fish-like deity, possibly a totemistic ancestor.

Lips sewn

The head was prepared with even greater attention. The graying hair was left uncut. The chief's mouth was stuffed with cotton as were the nostrils, and the lips were then sewn together. There seems little doubt that these were precautions taken to prevent the spirit of the dead from returning, for similar customs have been reported among several

primitive peoples—to mention one of many, the Jivaro Indians of Ecuador, the celebrated head-hunters, who performed similar operations before shrinking the heads of their victims.

The eyes and forehead were padded with cotton, held in place by a loosely woven square cloth which covered the top of the head. Another cotton pad was placed at the back of the head, and over all a head band of a many colored pattern was wrapped tightly, with a single yellow feather tucked in at the back. To this band a gold bar and a six-pointed gold star were sewn at the front of the head (possibly another astronomical ornament), while at the back was a winged gold pendant ornament with a simple face design. Above each ear was a thin gold disc with a row of seven cut-out cats around the edge and a row of five renditions of the same animal around the center. The general shape of the cat, with pointed ears and curled tail, was cut out of what might pardonably be called whole metal, while the eyes, nose and mouth were indicated by small punches. The repetition of this cat design, not only in metal ornaments but in cloth embroidery lends weight to the suspicion that, like the fish, it was also a deity.

The first interment

The ornaments with which the chief was adorned may very well have been made up of gifts brought by relatives and presented to the body as it lay in state. Once these had been fixed into their proper positions, the preparators gave thought to the chief's needs during his long journey to heaven. This, of course, meant food. Ears of corn, chili pepper, peanuts and some sort of root plant were placed next to the body. This was not the ordinary sustenance of the chief's earthly existence, but merely the portable types of food that would be carried by anyone on a journey of considerable length. In order to make the pilgrimage a little more pleasant, a calabash containing liquid, perhaps the *chicha* corn beer, was carefully taped and tied around the chief's neck in a net bag. Some plain cotton shirts and shawls, probably the garments he wore in everyday life, were then added. This seems to indicate that the chief was not expected to increase his stature during the first stage of the journey. Some small bags containing powdered dyes were included, possibly because the chief had been noted among his people as very proficient in the art of dyeing. Two throwing slings of plaited maguey fiber were placed around the chief's neck so that he might have his weapons in readiness for any spiritual emergency. Finally a head turban covered solidly with yellow feathers was placed over the head; then, as the initial ceremony ended, a

plain wrapping was carefully wound around the body in concentric circles and sewn up tightly. The body was then ready for its first interment.

Several weeks later the bundle was taken out of the ground, along with those of other notables who were judged to have completed their first stage, and carried from the grave in a solemn procession probably including the entire population. The mummy bundles were placed in a ceremonial circle where they were served with food in the order of their rank during life. Shortly after this, the shawls and shirts and other textiles needed on the second stage of the journey were fixed in position. Various other paraphernalia were added, and probably the food served at the banquet was also included. When the second ceremony had been completed, an ornamental turban was placed on the top knot of the first bundle. Since the body was never removed from the original bundle, we can assume that this top knot was regarded as a substitute or false head. A second plain cloth wrapping, exactly like the one used as covering in the first burial, was then wrapped securely around the now larger bundle and tied in the knot that would become the false head for the third turban.

Final rites

Thus the process went on at regular intervals, each new burial being preceded by the addition of more clothing and food for the ensuing stage of the journey and a turban being placed over the false head of the preceding bundle. When the fourth burial took place, the chief was assumed to have died at last, and to be safely launched on the fourth and final stage of his heavenward journey.

The foregoing conjectural account of the funeral customs of the little known pre-Columbian Indians on the peninsula of Paracas was reconstructed chiefly from the examination and description by Dr. W. C.

Bennett, Assistant Curator of Anthropology, American Museum, of one of the 429 mummy bundles uncovered on this peninsula by Dr. Julio C. Tello. The material was loaned to the Museum by the Hon. Manuel de Freyre y Santander, through the courtesy of Hon. General Oscar R. Venevides, President of Peru, and Hon. Ernesto Montagne, Minister of Education. Although the assumptions made here are tentative, they represent in a general way the best information that can be brought forth at this time. These people had no written language therefore all of our reconstruction of their life is inferred from excavations at the site of their civilization. But the story of the four stages in the funerals of ancient Paracas seems reasonably credible in the light of similar customs in later Peruvian civilizations of which our information is far more complete.

Noteworthy textiles

The mummy bundle illustrated in the accompanying photographs is now on temporary exhibition in the American Museum through the courtesy of the Peruvian Government. Visitors will be able to examine at length the beautiful weaving and embroidery work executed by this ancient people and preserved for our eyes by the extreme aridity of the Paracas climate.

There can be little doubt that Doctor Tello by his discovery of these mummies, four of which are now under examination in the Museum, has shed valuable light on a civilization of major importance.

In all, 429 mummies were removed from this one site, representing two periods. Some of the chambers were as much as 20 feet underground, and were entered from above by tubular shafts.

Further examination of all 429 mummy bundles will undoubtedly lead to a more complete understanding of Peru's past than has heretofore been possible.

THE STORY OF PLANT EVOLUTION BRIEFLY TOLD

From geology we learn that in early times the earth was largely covered by water. That life in water preceded life on land is indicated by three distinct lines of evidence: by fossils, by comparison of present forms, and by their individual development. After ages of water life, certain plants and animals became adapted, first to marsh life, and then to land life; other plants remained about as they were. Land plants early acquired land characteristics: roots to take in moisture, leaves to take in light, and seeds for more effective reproduction. Much later came the modern flowering plants and pollinating insects. The story of plant evolution covers a vast time, approximately a thousand million years. Six principal stages are illustrated below by living plants: 1-WATER PLANTS, 2-MARSH PLANTS, 3 to 6-LAND PLANTS: 3-Roots, 4-Leaves, 5-Seeds, 6-Flowers.

LAND PLANTS

MARSH PLANTS

WATER PLANTS

1 WATER PLANTS, such as *Algae*, usually have eggs exposed, and rarely live out of water. Blue-green or slime algae (e. g. *Gloeothece*, below at left) float on the bottom of shallow freshwater pools; one-celled, mostly without nucleus, they reproduce by cell division. Green algae (e. g. *Ulva* or sea lettuce, below at right) have nucleus, are usually many-celled and often attached, and reproduce by special cells.



2 MARSH PLANTS, such as *Liverworts*, have eggs enclosed in small bottle-shaped structures called archegonia. Egg-cells are fertilized by swimming sperms (as shown) and develop into spore-bearing structures. We have here an alternation of generations, as first observed nearly a century ago by Hofmeister. Liverworts have no roots, and live mostly in moist places; they never grow large. Similar forms may well have been among the earliest plants to live out of water.

3 ROOTS with stems, to carry water and dissolved minerals into and through land plants were probably first developed *Clubmosses*. Present day clubmosses are small relatives of the clubmosses of former ages. Their spores develop into prothallia (shown above). These bear male and female cells, which unite and grow into the (asexual) clubmoss, which is the spore-bearing generation. Clubmosses have scales rather than leaves; these have a single vein and more than one spore case.

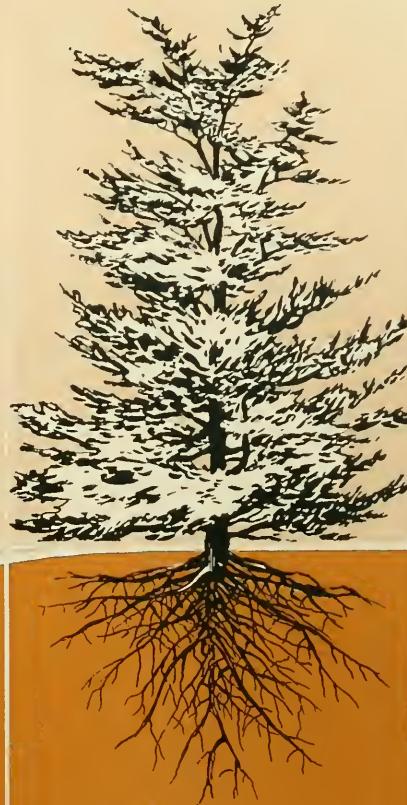


AIR

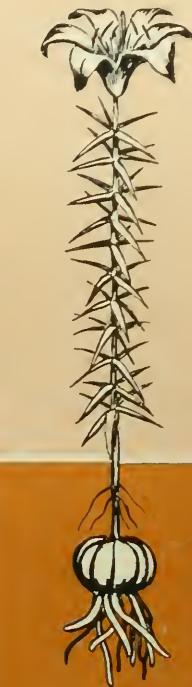
SOIL



LEAVES are now believed to have evolved from flattened and fused stems. They appear first in *Ferns*. Their large surface for taking in light makes them efficient in photosynthesis, that is, in building organic materials by the aid of light. A fern frond is, so speak, a clubmoss bent to one side and flattened, thus its leaves have branching veins, and spores grow on their under side. If they fall in moist places, they germinate to form prothallia. These produce male and female cells which unite and grow into new (exual) ferns.



5 SEEDS instead of spores enable cedar (above) and other *Gymnosperms* to withstand unfavorable conditions better than their predecessors. Seed-bearing plants all have small and large spores. The large developing spore remains attached to the mother plant. The small spore (called pollen grain) is borne by the wind to the large spore. Their contact and development result in the formation of seeds. More or less protected by coverings, the seed is capable of resisting a dry period by remaining in a dormant condition. A spore has only one cell, a seed is a complex structure, and contains a dormant young plant or embryo. Seeds are an important step toward the conquest of the land by plants. Cycads and conifers today represent the early seed-bearing plants.



6 FLOWERS have made *Angiosperms* or flowering plants the dominant vegetation of today. Whereas gymnosperms have naked seeds and no true fruit, angiosperms have seeds enclosed in an ovary, which develops into a fruit. The transfer of pollen from one flower directly to other similar flowers by insects contrasts with the wasteful wind-pollination of gymnosperms. To attract insects, flowers usually have colored petals and special nectar glands. A few angiosperms have reverted to wind pollination. There are more than 100,000 species of flowering plants, among which are included nearly all plants producing human food.

A. G. & M. H. P.
Brooklyn Botanic Garden



Photo by Capt. Ira Abbott

(Left) **RIGHT THROUGH THE SIDE:** A most unusual photograph showing a swordfish in the act of thrusting his weapon through the planking of a fisherman's dory. The photograph was taken from the deck of the schooner alongside. Five such attacks were made by swordfish on dories during the past year in New England waters alone

(Below) A HEART-PINE BOARD from the bottom of a skiff pierced by a swordfish's sword. The board was so splintered that the boat quickly filled with water

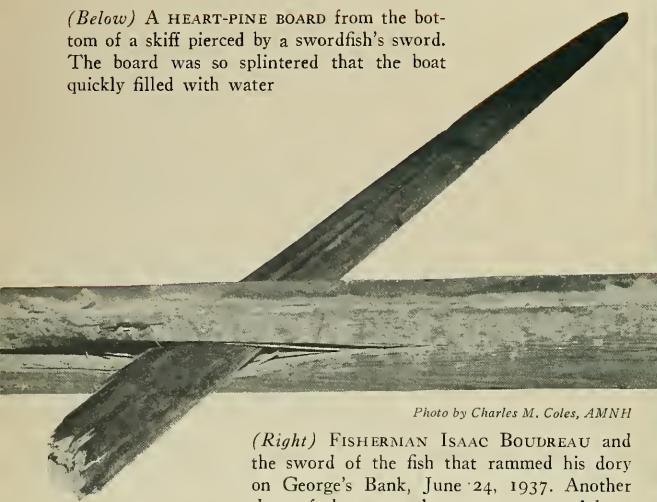


Photo by Charles M. Coles, AMNH

(Right) **FISHERMAN ISAAC BOUDREAU** and the sword of the fish that rammed his dory on George's Bank, June '24, 1937. Another dory of the same schooner was speared by a swordfish within two weeks

Courtesy, Boston Herald



TALES OF ATTACKS BY THE OCEAN GLADIATOR— *How the Swordfish, Xiphias gladius, wreaks occasional vengeance by spearing the dories of the fishermen who persecute him*

By E. W. GUDGER
*Associate Curator of Fishes,
American Museum*

XIPHIAS is a fish-eater, and being toothless must use his "sword" to get his food. He has been seen to rise up in a school of fishes and to strike right and left with his weapon, killing or stunning his prey, which he later picks up at leisure. Furthermore it has long been alleged by fishermen that he will sometimes transfix his prey with his sword. Indeed this has been seen and reported by one reputable scientific man. From this it is not a far cry to the habit of the fish when harpooned of assaulting with his sword the small boats of the fishermen. But before describing him in retaliatory action, the reader must be introduced to this gladiator of the seas, who in the past summer alone gave at least five New England fishermen-persecutors some unhappy experiences which will not soon be effaced from their memories.

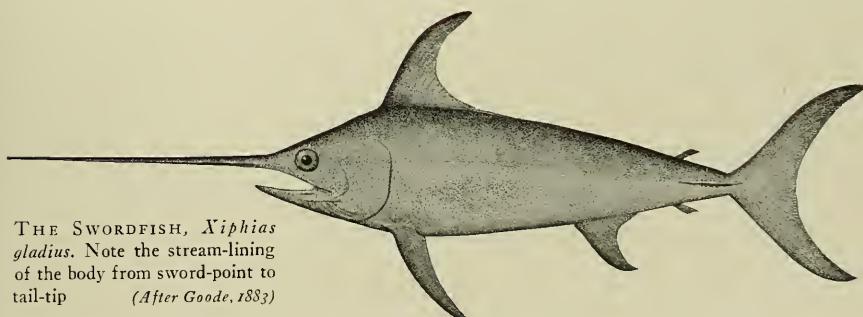
The "ocean gladiator," as the reader will observe from the illustration on this page, is the very epitome of stream-lining. He is shaped somewhat like a mackerel and from tip to tip is built on racing lines. His upper jaw and snout are prolonged into a horizontally flattened double-edged sword—whence he takes his name. His dorsal fin has a

sharp backward rake. His body, thickest in the region of dorsal and pectoral fins, tapers gracefully backward to a slender caudal peduncle strengthened on each side by a horizontal keel. And ending all is the great almost bilaterally symmetrical lunate tail fin, the great locomotor organ of this living torpedo. Our fish is truly the personification and acme of symmetry, beauty and grace. But, for all his grace and beauty, the combination of the trenchant sword and the huge staring eye do give Xiphias something of a sinister and formidable appearance.

Swordfishing in 100 B. C.

Swordfishing is an ancient and honorable—and dangerous—occupation, and whether practiced in the Straits of Messina about 100 B. C. or off Block Island in 1937 A. D., is based on the fact that Xiphias on calm sunny days loves to loaf at the surface of the sea. Basking in the sunlight with the upper part of his body—and especially the backwardly raking dorsal fin and the tip of the upper half of his great tail-fin—projecting above the surface, he is readily seen from the masthead at the distance of two or more miles.

For the beginning of swordfishing, we must go back beyond the earliest dated histories of the peo-



THE SWORDFISH, *Xiphias gladius*. Note the stream-lining of the body from sword-point to tail-tip
(After Goode, 1883)

ples inhabiting the northern shores of the Mediterranean Sea. For the first written account of harpooning the fish and of its retaliatory attack we retrace nearly 2000 years and go to Strabo, the celebrated Greek geographer (63 B. C.—c. 24 A. D.) who wrote in 17 books a geography of the countries surrounding the middle sea. The fishing method practiced in the Strait of Messina, as briefly described by Strabo, is in all but the small details that used there today, and in its broad essentials that followed by the present-day swordfishermen of the New England coast. This short account by Strabo is historically and practically so interesting that it will be quoted in full. Strabo had it from one Polybius (204 B. C.—125 B. C.) whose account in his History of Rome was written about 100 B. C. but is no longer extant. Strabo describes the swordfishing at Scylaeum on the mainland side of the Strait of Messina more than 2000 years ago as follows:

One lookout [on the rock Scylla?] directs the whole body of fishers, who are in a vast number of small boats, each furnished with two oars, and two men to each boat. One man rows, the other stands on the prow, spear in hand, while the lookout [on land] has to signal the appearance of a sword-fish. (This fish, when swimming, has about a third of its body above water). As it passes the boat, the fisher darts the spear from his hand, and when this [staff] is withdrawn, it leaves the sharp point with which it was furnished sticking in the flesh of the fish. This point is barbed, and loosely fixed to the spear for the purpose; it has a long end [of line] fastened to it; this they pay out to the wounded fish, till it is exhausted with its struggling and endeavors to escape. Afterwards they trail it to the shore, or, unless it is too large and full-grown, haul it to the boat. If the spear [shaft?] should fall into the sea, it is not lost, for it is jointed of oak and pine, so that when the oak sinks on account of its weight, it causes the other end to rise, and thus is easily recovered. It sometimes happens that the rower is wounded even through the boat, and such is the size of the sword with which the galeote [i.e., swordfish] is armed, such is the strength of the fish, and the method of capture, that [in danger] it is not surpassed by the chase of the wild boar.*

From the Strabo-Polybius fishing in the Strait of Messina (c. 100 B. C.) to that practiced today on the New England coast (1938) is a great time traverse surely calling for seven-league boots. It would be interesting to trace the intervening history of swordfishing, but this would take us too far afield. It will be well, however, briefly to describe present-day swordfishing in New England waters, since this is necessary to an understanding of the psychology of the fish and of its attacks.

*The Geography of Strabo, London, 1903. Trans. by C. H. Hamilton and W. Falconer. (Swordfishing at Scylaeum, Bk. 1, chap. ii, § 16, pp. 36-37.)

This fishing off the New England coast in the year of grace 1938 is carried on largely from schooners, as shown in the illustrations. Such a boat has sails and uses them, but for emergencies and when speed is needed she is equipped with a motor—generally a Diesel. The fish are harpooned and brought aboard, heads, tails and viscera are removed, and the valuable bodies are iced down in the hold. When a "fare" has been obtained, the vessel heads for home and a market.

As in and before Strabo's day, 2000 years ago, so today the essential crew of a "sworder," are the lookout man, the harpooner and the locomotor man—here the engineer and steersman. Since New England fishing is done mainly out in the open ocean and since large areas must be watched under a glaring sun, two and sometimes three or more masthead men keep watch from small platforms at different levels. The post of the harpooner is in the "pulpit" at the end of the bowsprit. This pulpit consists of a small platform secured onto the outer end of the bowsprit. From the platform, iron rods extend upward and are secured to an iron ring at about the level of a man's hips. Generally the ring is open at the rear and frequently it has there a swinging seat for the harpooner when "at rest" while the boat is cruising around looking for swordfish and the steersman is idling at his wheel in the rear.

When the cry "Swordfish!" rings out, all come to sudden and active life. And now there is brought into play splendid team-work between lookouts, steersman and striker. The men aloft by shouts and gestures direct the steersman where to head the boat. The steersman cannot see the fish and the judgment of distances and directions by the masthead men must be keen to put the harpooner "on the fish."

Just here it must be said, that a basking swordfish shows little or no fear of a bucking plunging schooner, but does seem to dread a small boat. Hence there is little striking done from rowboats, as practiced in the Strait of Messina in ancient days and at the present time. In New England waters, the harpooning is invariably done from the bowsprit of a schooner.

The harpooner is now "put on the fish"—i.e. brought to within 10 or 12 feet—and as the fish, almost under the bowsprit, partly turns one great eye upward, with tense arm the striker poises his long harpoon pole, and at the exact moment with unerring aim drives the harpoon into his prey, as shown in the pair of remarkable photographs on a following page. The fish awakes to tremendous activity and rushes away at top speed. The lanyard or

"bib" line attached to the pole is held by the harpooner and when it comes tight the pole is snatched out of its socket in the base of the harpoon and is recovered as it was in Strabo's time. But attached to the harpoon near its head is a line, often 100 fathoms long, having at its inboard end a keg or float. As the line grows taut, the keg is thrown overboard, and the fish is left to exhaust itself dragging line and float in its erratic wake.

When it is judged that the fish has tired itself sufficiently, the next operation is begun. The schooner following the keg, drops a dory overboard with one or sometimes two men in it. The man rows up to the keg, takes it aboard, and begins to haul in the line bringing boat and fish steadily closer together. His purpose is to bring the fish alongside so that it may be killed with lance cuts in the gill-region. When thus brought within 10 or 15 feet of the boat, *Xiphias* often takes command of the situation and turns the tables on the fisherman. This will now be shown in the recital of seven as yet unrecorded swordfish attacks on dories in New England waters alone, five of which occurred in the summer of 1937, when there was almost an epidemic of assaults.

Two attacks—1928 and 1936

For the photograph and the account of this attack, I am indebted to the interest and courtesy of Dr. Charles D. Hart of Philadelphia. Doctor Hart not only loaned me the original negative but sent me an account of the incident. The photograph was taken by Capt. Ira Abbott of Yarmouth, Nova Scotia, who at the time was master of a yacht on a cruise to the north out of New York. The picture was snapped some time in August, 1928, about 120 miles east of Nantucket Lightship in the vicinity of George's Bank. Here is Captain Abbott's brief account of the incident.

We harpooned the fish and sent a man out in the dory to bring it alongside the yacht. As the man in the dory seemed to be having difficulty in bringing the fish to the surface, I anticipated trouble of some sort, and was standing on the deck of the yacht with my camera all ready. When I saw the flash of the fish as it broke the surface of the water, I pressed the trigger of the camera with the result as you see it in the picture. An instant later, the fish gave a savage lunge and tore a large hole in the dory causing it to sink. We got the man aboard the yacht safely and later succeeded in capturing the fish, which weighed 350 lbs.

This extraordinary snapshot, reproduced here for the first time, shows the right side of the rear end of the dory with the sword protruding through a plank at about water level. Had the snapshot been

made a moment later the sword would have been shown intruded further into the dory. Below the sword is the left lower jaw dimly outlined under the water. Further to the left is seen the rope from the keg (already in the boat) leading to the base of the harpoon slightly under the surface of the water.

Thanks to Captain Abbott's alertness this photograph was taken at the very moment the stroke was delivered and before the boat sank. It is surely unique and will have a high place in the history of swordfishing.

In August, 1936, Mr. G. M. Phelps, Jr., of New York City, was out swordfishing off Montauk Point, Long Island, a locality where these fish are abundant enough to foster both commercial and sport fishing. The fish had been harpooned from the pulpit of the boat and the line with the attached keg had been thrown overboard. The keg floating at the surface acts as a drag or brake to the fish, and in pulling it about the fish rapidly tires itself out. So this fish supposedly did, and presently Mr. Phelps and one of the fishermen went out in a skiff to pick up the keg and bring the fish aboard.

Usually a swordfish thus harpooned puts up a hard fight, drags the keg hither and yon for an hour or more and resists being brought to the boat. However, this fish was a young one and did not behave as the older and stronger usually do, but at this juncture it followed the line quietly toward the skiff. However, *Xiphias* was by no means exhausted. When it saw the boat floating on the surface about fifteen feet away, it must have taken it for an enemy or an object in some way allied to its present hurt, or perhaps its action was a result of what one author calls its "choleric disposition." At any rate it charged the skiff and drove its sword through a three-quarter-inch heart pine board in the bottom of the boat—fortunately without striking either of the men.

Then the fish in a frenzy lashed out, and, after shaking the boat for some seconds and nearly upsetting it, broke off its sword, leaving the point extending diagonally through the splintered plank a distance of 18 inches into the boat. Seemingly exhausted by its efforts, and apparently subdued by the loss of its weapon, the fish allowed itself to be hauled aboard the dory. The photograph on page 128 shows what happened. The sword is here seen to have entered the board from the outside and to have split it longitudinally. The total length of the broken-off sword is 25.5 inches.

The skiff, rendered useless by this mishap, had to have the old plank taken out and a new one put in. Mr. Phelps secured the board with the sword still in it, and judging that it would be of interest and value to us in the Museum, brought it to my col-



R. I. Nesmith and Associates

(Above) THE LATEST TYPE OF MASTHEAD LOOKOUT—5 men in 3 tiers. Since the lookouts, 60 feet in the air, experience the maximum roll of the vessel, they are fastened by belts like those worn by window cleaners

(Right) A NEW ENGLAND "SWORDER" or swordfishing schooner. Note the harpooner in the pulpit on the end of the bowsprit, the skipper and assistant at the wheel, and the lookouts at different levels on the foremast

Photo by courtesy Gloucester (Mass.) Chamber of Commerce



(Below) A SWORDFISH "finning." The fish habitually loaf along in bright calm weather, with dorsal fin and upper lobe of the great tail project-

ing above the surface of the sea. Thus basking he is visible to the masthead men as much as two miles away



THE SWORDFISH does not fear a bucking, plunging schooner. *Xiphias* may rise under the forefoot of the vessel, but turns aside and is never struck

*Photo by C. E. Pelissier,
Courtesy Fishing Gazette*





(Left) STRIKING THE FISH: An action photograph of the harpooner at the moment of the thrust. The upper line of the harpoon serves to retrieve the handle which comes loose from the "lily iron" embedded in the flesh. The lower line is attached to the harpoon head and is fast to a floating keg, which hinders the fish's efforts to escape. Note the construction of the pulpit

Photos
courtesy of
Gloucester
(Mass.)
Chamber
of Commerce



(Right) MAKING OFF: The stricken sword-fish seeks to escape. The harpoon shaft has not yet been detached and retrieved

(Below) XIPHIAS, THE OCEAN GLADIATOR, drawn up to the dory. Note the huge staring eye and the trenchant sword, which give him a sinister and formidable look

Photo from R. I. Nesmith and Associates

HOISTING the heavy catch aboard. Xiphias may object, but block and tackle, and Diesel engine are too much for him

Photo by courtesy of Gloucester (Mass.) Chamber of Commerce



league, Mr. J. T. Nichols, who has kindly turned it over to me for description. It is a most unusual and interesting specimen.

The 1937 epidemic of attacks

There was almost an epidemic of attacks in the swordfishing season of 1937. These came to my attention through the medium of newspaper notices and the letters of friends. Further, details in nearly every case were communicated by the fishermen themselves, and their splendid cooperation is hereby gratefully acknowledged.

Earliest of all the accounts of swordfish attacks for 1937 is one in June. The *Boston Herald* of June 28, published a picture of Isaac Boudreau of the schooner *Andrew and Rosalie* of Gloucester, holding in his hand the weapon of an ocean gladiator which had rammed his dory on June 24 on George's Bank about 75 miles S. by W. of Gay Head. The picture is on page 128, and here is the *Herald's* account.

The swordfish was harpooned from the pulpit of the schooner *Andrew and Rosalie* . . . southeast of Block Island, June 24, and Boudreau went out in a dory to play it. For an hour and a half the big fish towed the little craft about in various directions, alternately leaping from the sea and sounding to great depths, and finally when the dory was three miles from the mother vessel, the fish dived and came up directly beneath the boat, piercing the bottom with its sword.

Momentarily expecting the boat to be shattered by the struggles of the heavy fish, Boudreau signalled the schooner for aid. When the swordfish made no further movement, he realized that its attack on the dory had been its final effort.

Mr. F. E. Firth, a collector of biological data for the U. S. Bureau of Fisheries, stationed on the Fish Pier, Boston, has been at the pains to interview Capt. James Abbott of the *Andrew and Rosalie*, who confirms the account but adds certain details.

Isaac was out alone hauling in the keg and line, and when the fish got near the dory, it suddenly turned toward it and rammed its sword through the planking of the bottom, the sword sticking through about a foot. Isaac, rather scared, had perched himself on the rear thwart of the dory and so escaped any possible injury. The sword broke off and the fish was soon captured. After the men unloaded their fish, they cut the sword off, i. e. the parts projecting inside and out and the rest of it still remains in the dory. This natural plug saved them the expense of putting in a new plank.

The dories of the *Andrew and Rosalie* would seem to attract swordfish—at any rate another one was rammed shortly after the attack of June 24 just

described. During the first week in July, 1937, this vessel made another trip to George's Bank for swordfish. A large fish was harpooned and the keg thrown overboard in the orthodox manner. When the fish had supposedly worn itself down, Steve Powers was sent out in a dory to haul it up, lance it and bring it to the vessel. But the fish was hauled up too soon, and retaliated by spearing the dory, thus necessitating help from the schooner. Further details are unfortunately lacking.

Under the headline, "Block Island, R. I., July 5, 1937," the Associated Press sent out the following story which was widely published, excerpts from three separate papers being sent me. Here is the account.

Capt. Alfred Cyr of the sloop *George A.*, Block Island, narrowly escaped serious injury near here today when a swordfish charged the small boat he was in, ran its sword through the craft, and wounded him in the chest.

Captain Cyr had taken to the boat to haul in the 200-pound fish, harpooned a short time before from a larger craft. He said that he saw the fish coming but was unable to move out of its path. The captain suffered an abrasion of the chest, but he got the fish.

I at once wrote Captain Cyr for the details of this attack but had no answer—probably he was away on another trip. However, Capt. Ira Abbott was at Block Island a few days later and made inquiries about the incident. He kindly writes that the above account is authentic. Captain Cyr got off lightly, for not infrequently the occupant of the dory is hurt, and occasionally a fisherman is killed by the charging fish.

The next attack of the season occurred on July 10 in the Atlantic off the northeast end of Long Island, not far from Montauk. It was recorded in the *New York Times*. I shortly thereafter got in touch with Mr. John Maxson of the schooner *Adelaide T.*, the man concerned, and I had from him the following vivid account of what took place in the encounter with his 300-pound swordfish.

We harpooned the fish, July 10, off Easthampton, L. I. But in the meantime we landed a very big fish which required much hauling and tugging for about an hour altogether. This took most of the pep out of me, so when we sighted another one about five minutes later, I vowed that this one was coming in fast—which he did to my regret.

I hauled on the line until he was about ten feet from me when I let him tow me. This he did for about two minutes, when without any warning he turned and fastened his sword all the way into the dory at the water's edge. So I hauled in all the slack I could and tried to get his tail out of water, but he was plenty mad and made quite a fuss. So

I signalled the big boat to come alongside, since in the meantime the dory was filling rapidly.

They came alongside and put a small steel cable around his tail and started to haul him in. However, he had other ideas and put up quite a fight, but the power from a 60 h.p. Diesel engine was too much for him. Incidentally the reason for the great struggle was the fact that when we started to pull him aboard, we broke off his sword.

This seems quite tame when I sit in the comfort of the cabin and write about it, but let me assure you that it was no picnic while it lasted.

Capt. Ira Abbott (quoted above) was fishing off Montauk, Long Island, during July and August 1937 and among his experiences was that of having another dory rammed by a Xiphias. He writes me as follows:

We were cruising around off Montauk about July 12, looking for swordfish when our lookout at the masthead sighted a fish right ahead. The owner of the yacht ran forward to the swordfish stand and harpooned the fish. But unfortunately the harpoon struck forward of the dorsal fin and near the head. It usually happens that when a swordfish is harpooned in or near the head it seems to go crazy and starts looking for something to attack. This fish came to the surface after the first plunge downward and started cutting circles around the boat. We went on to it again and a second harpoon was driven into it. Still the fish would not go down and I put out in a dory to play it.

I hauled on the line from the keg till I got within about 20 feet of the fish. Then it suddenly turned and like a flash drove its sword through the dory. Fortunately the sword did not strike me, but that was just my good luck. After striking the dory, the fish thrashed about so hard that it almost threw me out of the dory and did break off its sword at a point just below where it went through the bottom of the dory. We secured both sword and fish and brought them into Montauk. The sword is the one I sent you.

Why do swordfish attack dories?

The larger question, why swordfish attack vessels (not dories) and particularly wooden sailing vessels on their voyages over the seven seas, cannot be answered here. The question must be confined to attacks on dories, and the answer is difficult to arrive at.

The names of our fish—*Xiphias gladius*, the broad-bill or broad-sword swordfish with good reason emphasize his singular weapon and hint of his choleric disposition. Both words mean sword—*xiphias* is Greek and *gladius* is Latin. Let it be recalled that the Roman emperor was represented with a drawn straight sword (comparable to the fish's) in his hand. The French call our fish Empereur, Épée de Mer, and Espadon; and we often

hear it called "the ocean gladiator." The idea of the fish's pugnacity is a very old one. The Greek poet, Oppian (172-210 A. D.) speaks of *Xiphias* as "extravagant in folly and in fear," and says that:

Nature her Bounty to his Mouth confin'd
Gave him a Sword, but left unarm'd his Mind.

One American writer speaks of his "choleric disposition," and another writes "It surely seems as if a temporary insanity sometimes takes possession of the fish."

However, there is among many fisherman strong belief to the contrary. This is well set out in a letter from Mr. F. E. Firth, who has been referred to above. I can do no better than quote him.

Today (July 23, 1937), I had a long discussion with the captain and the entire crew of the vessel *Sunapee*. Capt. Ed. Smith and Mate Jud Stinson have been pursuing the swordfish together for 28 years. The chief striker, Archie Stevens, and masthead man, Bill Conrad, have been in the game for over 15 years. Here are facts I obtained from these men, keen observers all.

They are unanimous in their conclusion that swordfish are perhaps the greatest cowards in the ocean, in other words they are so easily scared that they jump away from each other when they happen to come in close proximity. Even a bit of floating seaweed may scare them away. They are not savage but quite the opposite. As one man put it—"They lean over backward the other way."

I may add just here that it has been long held by some American writers on the swordfish—from 1886 to 1925—that they are inclined to be solitary in habits, shy, and easily frightened. This matter will be gone into further in the historical paper referred to.

But they do attack dories and schooners, and the ever insistent question is "Why?" In answer, it may be said that Goode in his great article published in 1883* quoted many swordfishers that practically every swordfish does this when struck in the head, and that the fish goes crazy and attacks the first thing in sight—generally the dory to which he is being hauled.

As Capt. Ira Abbott has phrased it—"When a swordfish is harpooned in or near the head, it seems to go crazy and starts looking for something to attack." And Capt. James Abbott told Mr. Firth that, "This [attack on a boat] only happens when the fish is harpooned in the head as was Boudreau's fish. It drives the fish crazy and they lunge about wildly until finally captured."

*Goode, G. B. Materials for a History of the Swordfish. Ann. Rept. U. S. Comm. Fish and Fisheries for 1880, 1883. 106 p., 24 pls.

Here is the testimony of Capt. Ed. Smith and his crew as given to Mr. Firth.

The swordfish are never vicious except when harpooned in the head or in the spinal column near the head. Even when hit here, a good man will have no trouble with the fish if he does not attempt to haul it in too soon, before it has drowned. But the trouble comes when the man hauls him in without waiting. And even then the fish does not attack the boat but rather the warp line which is being hauled into the boat with the fish on it, and consequently the fish slams his sword into the boat. Dories and vessels are struck with swords only when the wild crazed fish are hauled in too quickly.

Then Mr. Firth concludes thus:

I think Jud Stinson's words are very good: "Swordfish hit in the head, hit the dories and boats not because they see the boat but because they follow the warp back to the boat. [This is what Mr. Phelps' fish at Montauk, 1936, was said to have done.] When hit in the body they don't see the line because their head is down and they can't follow anything." So far as I can learn, these crazed fish swim wildly in circles when first hit in the head and strike the first thing they come to whether dory or boat.

Still another view is that of Mr. William H. Hand Jr., naval architect, of New Bedford. He writes that in 23 years' experience in swordfishing with considerably more than five hundred fish taken, he has never seen a swordfish deliberately attack a schooner or other vessel, but he has seen a number of them deliberately attack dories. Then in another letter he says that:

Swordfish do deliberately attack dories at times. This I have seen with my own eyes on a number of occasions. I have seen fish try several times be-

fore contacting the dory properly to drive the sword through. There is not the slightest doubt that on occasions swordfish will attack dories. It is usually the smaller fish that do this but in my opinion it makes very little difference where they are struck.

The reader now readily agrees that swordfish ram dories. The testimony is incontrovertible. But he still has the question—"In the face of these different opinions by dependable men of much experience in swordfishing, what conclusion can I draw to the real cause of these attacks?" I have unfortunately never harpooned a swordfish and I have never been in a dory when it was rammed nor have I even seen it done. But I have thought for months over this conflicting testimony and have tried to form a conclusion for myself.

That a swordfish struck in or near the head would lose its sense of equilibrium is readily comprehensible. That such a fish held by a line would gyrate around in circles seems sure. That such a stricken fish when hauled in toward the dory, in order to ease the pain augmented by the pull of the line on the harpoon embedded in the flesh, would follow the warp straight toward the boat is understandable. That this fish, when close enough to perceive the boat ahead of it, would associate it with the cause of its pain and loss of freedom, seems not improbable. If these are sound conclusions as based on the facts, then we may go further and confidently expect the attack to follow, and it would look like a deliberate one.

This is my conclusion. If the reader with all the facts and conjectures before him comes to a different one, that is his right since the matter is one of opinion rather than fact.



ARUBA, CINDERELLA OF THE CARIBBEAN—*Two fairy godmothers tried to bring fame to this little island through her mineral charms; but as a distributing center for "liquid gold," "Cinderella" finally came into her own*

By JUANITA DESBRIERE

IN THE DAYS when the sleek, swift pirate ships roved far and wide over the blue Caribbean, many of them must have dropped anchor at the little Island of Aruba. It was not the hope of restocking their water supply or of staving off scurvy with succulent tropical fruits that brought them there. For unlike her nearby sister islands—Curaçao and Bonaire—Aruba has no fresh water springs and is blessed with little vegetation. The pirates came to lurk behind the coral reef of Manga Cora's *laguna* at the south end of the island facing Venezuela, from which they had a marvelously clear view of all ships passing from east and west—a view that takes in the mountains of Santa Anna far inland in Venezuela.

Did the pirates hide their treasures in the caves and grottoes of this small coral island? Possibly, but no one has ever found them, although natives and visitors have searched for more than two centuries. Nor did Aruba's earlier visitors find much of interest on its almost barren expanse of 65 square miles. During Columbus' third expedition in 1499, some of his pilots sighted the island, charted it, landed, and then left. They had not found what they were seeking—what all early adventurers in the Caribbean sought—gold.

Neglected

At the time when all were seeking the fabled El Dorado—and nearly finding it among the Incas and Aztecs—there was little to attract the lusty conquistadores to this long narrow strip of land, capped in its hilly center by the 2100-foot mountain peak of Yamanota and fringed on the east by a jagged coastline of steep cliffs. The marshy west coast had openings for two excellent harbors, it was true, but in those days of pillage and plunder who cared for remotely potential trading centers?

About the year 1527 a Spanish planter from Santo Domingo who had been given the stewardship of the islands along the Venezuelan coast, reported to his king that they were all *povre islas inutilas*—poor, worthless islands. And so Aruba was left largely to its native inhabitants—the Guarani Indians who had migrated across the twelve nautical miles that separate the island from the Venezuelan coast. Like Cinderella, this isle lay languishing outside the trade-wind mainstream of colonization, while her better favored sisters, in particular Curaçao prospered in the commercial activities of that colorful era.

Even today the record of her loneliness is preserved in the high cheekbones, the copper-colored skin, the sharp thin nose and small oval eyes of the native Arubans, who bear so close a resemblance to their relatives on the Venezuelan mainland. No slave market ever flourished on Aruba, and so there is none of the admixture of African characteristics so marked in the faces of the natives of Curaçao, less than fifty miles to the west. Although Aruba has been a Dutch possession for more than two centuries, the tradition of its earlier period still holds strong and the fishing smacks of the Venezuelan natives opposite still ply their trade off Aruba's shores.

Goats

It was not until after she became a Dutch possession that this Cinderella island had any hope of a turn in her fortunes. The Dutch West Indies Company was organized in 1621 for the purpose of uniting Holland's separate possessions in a smoothly articulated commercial enterprise and to prevent the constant squabbles which arose as a result of competition between the individual colonies. This company rapidly became a great power, but even under its control Aruba accomplished little. The company found it sufficient to levy a tax payable in hides

and salted goat meat and left the inhabitants to fare as best they could. The skinny, tick-laden goats which still swarm unchecked over the island, seemed the only thing of any possible value to these shrewd Netherlands traders. Manhattan, then New Amsterdam, was under the supervision of the company; and Peter Stuyvesant was at one time governor of Curaçao. It was at that time, in a battle fought off the island of Sint Maartin, that he lost his leg.

A small fort was built on Aruba at the site of its present capital, Oranjestad, and a governor stationed there. But the British captured and held the island from 1806 to 1815, returning it to the Dutch.

The first godmother

In 1824 the first of three successive fairy godmothers suddenly revealed to the world of commerce that this humble Cinderella island possessed a hidden charm. It was gold—the very thing the early explorers were too impatient to find on the island because there was no evidence of it in the tools and ornaments of the primitive inhabitants. A century previous when a minor gold fever had swept through the islands, the West Indies Company had commissioned a Danish geologist to prospect for the precious metal on lonely Aruba. But they allowed him too little time in which to make a complete study of the rocks and so harassed him that nothing was found in his premature report to warrant continued search. But this time, there could be no doubt about it. Some inhabitants had come upon nuggets in the Yamanota mountain region, and the government instantly made gold mining a state monopoly. The first year as much as two hundred pounds of gold were found. But as the output rapidly fell off thereafter, the government began to lose interest, and beginning in 1854, rented the Aruban gold concession to a series of private companies. One of these was a New York company which despite a capitalization of \$100,000 failed utterly. The last company to operate in Aruba, however, paid a dividend of 25% the first year.

Aruban ore is rich in gold and is abundantly scattered all over the island. One can pick up rocks all brilliant with the metal about any crude, abandoned shaft. But high taxes discouraged the industry.

Fifty years after the discovery of gold, a second benefactress appeared, revealing another mineral charm that lay beneath Aruba's drab exterior—phosphate. Production grew until between 1881 and 1909 the export to France, England, and the United States amounted to 446,445 tons. But just as "Cinderella Island" seemed about to come into her

own, she struck two exceedingly disheartening snags. First, Florida's extensive phosphate deposits were opened up, flooding the market. Then the World War brought a tremendous boom in Cuban sugar, and native laborers from all over the West Indies flocked by the thousands to work for fabulous wages. For (such are the vagaries of economics), there was more gold in Cuba's sugar fields than in all Aruba's arid hills.

This was a cruel blow to the Cinderella island. It seemed she would have to go back to the scullery—and an empty scullery at that, for Aruba was almost completely depopulated of male laborers. They had all packed off to Cuba and left their women and children literally to starve. Thus Aruba, apparently at the threshold of world fame, was forced to go "on relief." There were the scrawny goats, of course, a trifling amount of corn and beans, and one small banana grove, but Aruba's only significant agricultural product is of a medicinal rather than a nutritive nature. It is the plant aloe and from its Indian variant—Azua—the island is believed to have derived its pre-Columbian name.

Two-thirds of world's supply

This bitter aloe is the sovereign specific for all cuts and wounds among the natives of the West Indian islands. Every native grows at least one plant in his garden, as his personal medicine chest, using the pure, fresh juice of the leaves just as we do iodine. Aruba produces two-thirds of all the aloe used in the world. The plant is grown in broad fields wherever a little dirt covers the coral substratum. The Aruban variety is quite a small plant and the leaves which seldom exceed ten inches in length are the only part of the plant which are cut during the harvest from March to July. The main stalk of the plant is then left to grow new leaves for the next harvest. It is nice, lazy farming, just the kind to suit the Arubans—no plowing, no sowing, no irrigation. When cut, the leaves are placed in troughs that are tapped daily for the juice, and the odor of decomposition is nauseating. The juice is stored in vats, boiled down until only the extract is left, and the latter is packed and exported. This aloe extract has strong antiseptic qualities and is a constituent of patent medicines, to many of which it gives such an atrocious taste that the patients may well be convinced of its efficacy.

Prosperous aloe planters have made as much as \$10,000 a year, but its farming could never compensate for the loss of the gold and phosphate industries; moreover, there was barely enough labor

in Aruba during the war years to conduct even this easy-going enterprise.

And so once more Aruba seemed doomed to insignificance and neglect. While travelers in the post-war years flocked to Curaçao, Martinique, Haiti, and other West Indian islands, few if any thought to visit the Cinderella island's shores. A tourist passing the island on board ship would follow a shoreline of abrupt coral rock, would sight distant bare mountains, sandy beaches around blue *lagunas*—that is all. There is scarcely a tree or a flower to give charm and color to this tiny spot of earth. If the tourist were to inquire of the captain, he might learn that it is one of the so-called A B C islands (Aruba, Bonaire, and Curaçao). Once they were all thought to be part of the same oceanic ridge—mountain-tops emerging above the surface of the sea—but deep soundings recently made by Dutch gunboats have proved on the contrary that Aruba is a continuation of a peninsula jutting out from the Venezuelan coast. If Aruba were passed at night all the tourist would see of her would be the three lighthouses and perhaps the scattered lights of the capital seaport, Oranjestad.

To the natural history minded, Aruba's abundant lizards might arouse considerable interest. They range from tiny emerald-colored creatures to big blue ones, very bold and vindictive. Fierce battles among the latter variety in which one antagonist always meets death, are a common occurrence. Aruba boasts of only one poisonous snake, the rarely encountered pigmy rattler; but the writer has seen several nests of tarantulas. Of the pleasanter fauna, there is little of note save the *parrakeets* which are very noisy and quite numerous.

Aruba leaps to fame

Suddenly, when the little Cinderella island seemed engulfed in her darkest hour, the third fairy godmother came to the rescue. This time it was oil—the black liquid gold of modern times.

Oil was discovered shortly after the war, not on Aruba but in nearby Venezuela, and drilling was started with huge success. A fleet of tankers went in and out. But in front of lake Maracaibo where the principal wells had been sunk, there is a shifting sand bar over which only ships drawing very little water can pass, even at high tide. Small tankers, usually known as *lakers*, were for a time employed but their size prevented them from daring the high seas. The search for a suitable harbor near the source of oil led to the building by the Dutch Shell Company of the magnificent *baai* of Willemstad in

Curaçao. But under the pressure of competition, the rival Lago Oil and Transport Company searched for a port still closer to the oil wells. They found Aruba. And in 1925 the harbor of St. Nicolaas became their loading station. Daily the lakers brought the crude oil to Aruba where it was pumped directly into the large sea-going tankers which carried it all over the world.

Now Aruba began to ride the flood tide of returning fortune. Her possibilities claimed the attention of other companies. All her charms that had been kept in modest hiding now appeared in full view: the calm sea on her lee side, her good harbors, the magnificent climate, tempered at all times by the trade winds, her reputation for healthfulness and freedom from those tropical pests, mosquitos and other insects. The rainy season, too, is very short—from September to February, with real rain only from the middle of November until Christmas. The Cinderella island was only one hundred miles from Maracaibo, and it was as near to New York or London as to Buenos Aires.

Mushroom growth

In less than five months, the Dutch Corporation, Arends Petroleum Maatschappij, had built and was operating a small refinery north of Oranjestad. The orderly cottages for the employees were designed for tropical life, with tile floors, concrete porches and plenty of space about the houses; and fences were erected to protect them against the omnipresent goats, Aruba's earliest taxable product. The company's club greeted the employees of the Lago from St. Nicolaas and the prominent Aruban families as freely as they did their own employees. The little colony was prosperous and invitations to its dances were eagerly sought after.

Then the Pan-American Petroleum Corporation secured control of the Lago and planned a huge refinery in place of the little oil-loading station. A vast concession was granted, including the whole southern end of the island. Contracts were made for cracking units capable of taking care of 100,000 barrels of crude oil a day. Thus the second biggest refinery in the world was started.

In 1930, the Standard Oil of Indiana took over the Pan-American and more cracking units were under way. Over two hundred wooden bungalows of the Long Island type were built for the employees and have been painted each a different color.

The refinery itself is majestic. When seen at night with its thousand lights it looks like a fantastic Christmas tree made for giants. When one contemplates it at sunset, placed against a fairy-like back-

Continued on page 148

MILLIONS FOR DEFENSE—*On plants does the life of all things depend; and in self-protection these peaceful food-providers of the world have developed formidable defensive weapons ranging from the saw-toothed bayonet to barbed wire entanglements*

By HENRICKS HODGE

AMILLION unsheathed swords, as many lances; poison-tipped darts and barbed entanglements innumerable. A major, world-wide conflagration? No. Arms, these are, and millions of them, but possessed by an outstanding race of notable pacifists—the citizens of the plant kingdom. Theirs is a life passive yet vigorous, a life that the world's great nations might well imitate. For, though certain plants need the protection of arms, these arms are never used aggressively but only for defense.

Without arms then there would be war—there is war—an eternal one-sided war: belligerent animals versus defensive plants! Unlike most fighting nations, the animals have a genuine reason for conflict, for they must live and in order to live they must capture either some of their own kind or make captives in their stomachs of some of the plant kind. On plants does the life of all things hinge, from the tiniest one-celled sea-organism to the many celled animal that calls itself—man.

The basic food "formula"

The reason for this dependency is that in the chemical laboratories of the kingdom of the plants the formula has been long held in the most strict confidence which enables them, of all living organisms, to be the original manufacturers of foods. All plants are not "blessed" with this secret for all plants are not green, the essence of greenness being chlorophyll; and because of chlorophyll's sole ability as a synthesizer (in the presence of sunlight) to form complex foods out of the earth's raw materials which are free for the asking, there is war.

Food is frequently stored in the plant's body to be used in a future time of need. That this food supply is a bountiful one is well known to us for we make use of its stored forms by converting them into our

various plant-obtained products—starches of corn, potato and wheat. Other animals make a similar use in some cases to a greater degree even than we. All the larger mammals whose dietary is solely composed of herbage, animals known to us as herbivores, belong to this category. Such individuals are members of one of the plundering groups against which plants must guard themselves, for if they can in any manner ward off their attacks they are safe as far as this danger is concerned.

Origin of thorns

The first lines of defense, as we would expect, have as chief bulwarks protective modifications fashioned from one or more of the familiar plant organs—stem, leaf and hair. Easily molded, they have frequently been transformed with the result that their original use has been supplanted by one emphasizing protection. So one may find such organs which either wholly or in part have changed over to assume a protective function, a function quite different and distinct from the normal one, and in so doing they form the thorns, barbs, prickles, and knives which we run across in our everyday field excursions. We may have thought that all such plant protective devices had a common origin, and that they were identical in structure. This indeed is not the case for a thorn may be a transformed stem, leaf or "hair," or stipule as in the case of Black Locust (*Robinia*).

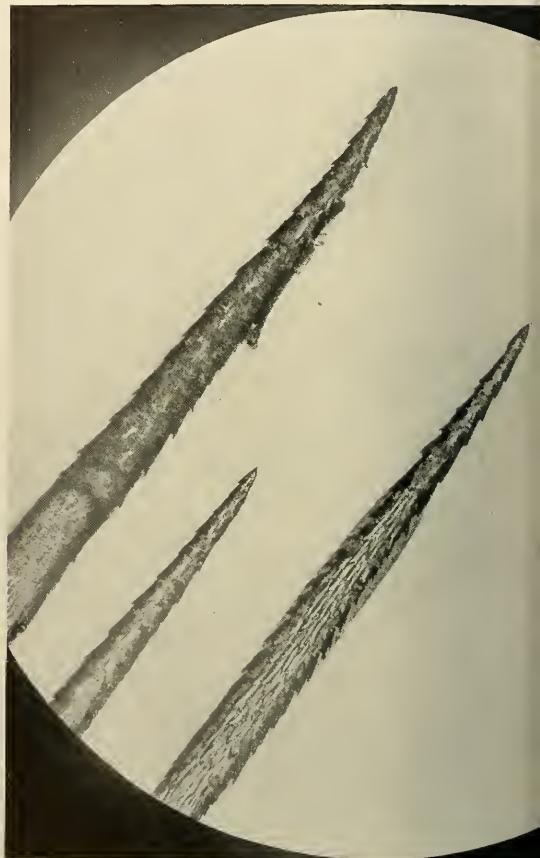
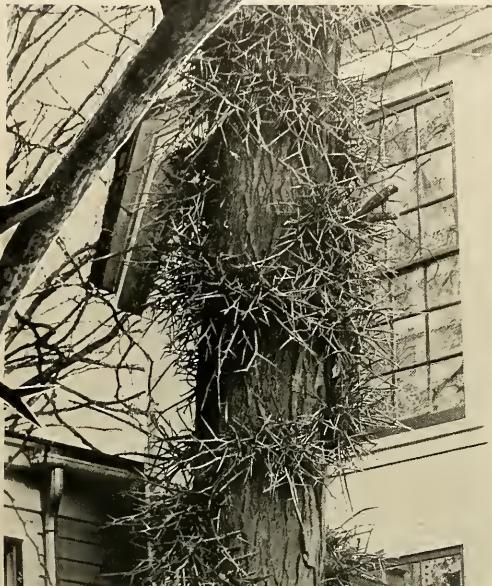
What people commonly call thorns are usually of deep rooted origin and are always found on plant stems. Their presence here is significant for it shows that they are but a form of stem . . . a lateral stem or branch which has never grown out as far as it should but has spent its energy in sharpening its extremity. As integral parts of the stem, such thorns are, needless to say, difficult of removal as can be ascertained by asking any youngster who has ever striven to break off a hawthorn thorn.

Have you ever looked at a thorn of this shrub in

All photos by
Henricks Hodges

PLANTS are the manufacturers of the original foods upon which all life depends. Against the animal kingdom, defense by means of thorns, barbs, and prickles is a vital provision in their "foreign policy"

THE BRANCHING THORNS of the honey locust (at left and left center) guard this species against molestation from every quarter: an example from Nature of successful though unaggressive armament



THE NEEDLES of the prickly-pear cactus, as shown in the microscopic photograph above, are lined with rows of backward-pointing barbs which cause them to work deeper and deeper into the flesh

THORNS one to three inches in length are familiar among the hawthorns, of which an example (*Crataegus punctata*) is illustrated at left. But on the Argentine pampas cattle men are said to have to protect their herds from thorn-bearing plants having weapons up to 25 inches in length

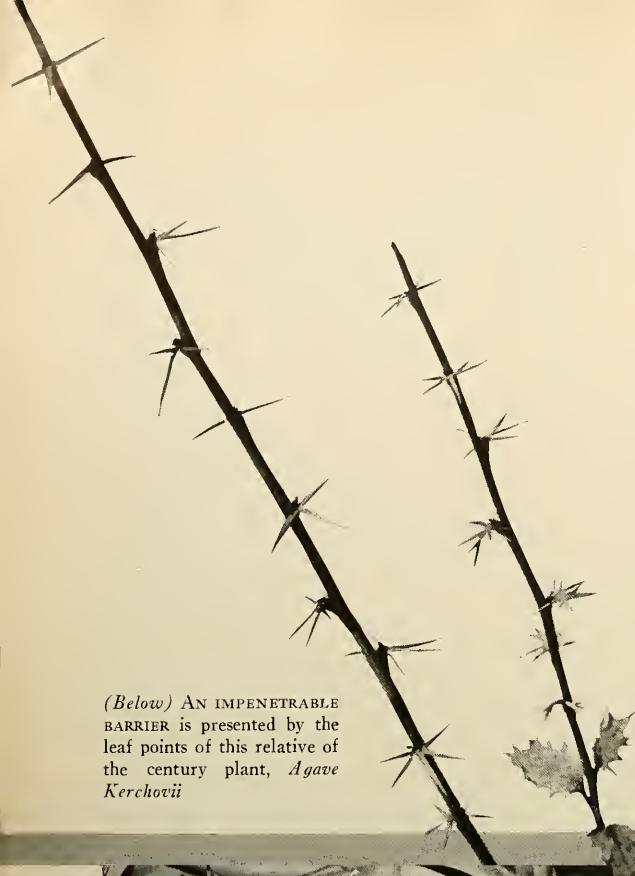
IN THE COLUMNAR or organ pipe cactus, typified by the various *Cereus* (example at right) and related species, spreading clusters of thorns lined up along vertical parallel ridges protect the grooves of green tissue lying between

(Below) A LIVING DESERT PIN-CUSHION: *Mammillaria Heyderi*



AN ODD DEFENSIVE FORMATION is seen in a member of the Buckthorn Family native to southern Brazil and Uruguay, *Colletia cruciata* (at right)





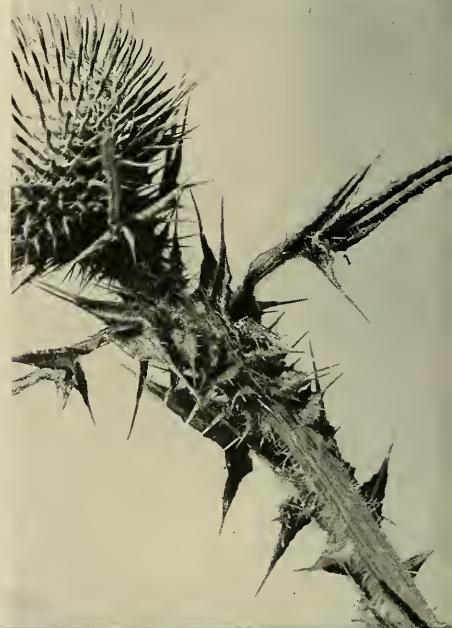
(Below) AN IMPENETRABLE BARRIER is presented by the leaf points of this relative of the century plant, *Agave Kerchovii*



THE SUCKER SHOOTS of the common barberry, *Berberis vulgaris* (at left), show a complete series of progressive transformations from normal leaves at the bottom to the triradiate thorns of the stalk's summit. Midway on this evolutionary ladder are organs—half leaves, half thorns—caught in the act of changing

(Below) THE THISTLE offers an unwelcoming exterior to a hungry grazing animal: another ramification of the defensive armament that plants have evolved to protect themselves

All photos by Henricks Hodge



(Right) THE STEM of the Omei Rose is bristling with thousands of barbs, large and small



NEARLY ANY PART of a plant's body can produce those tiny growths which for lack of a better name had best be called hair. Like other parts of the plant, these protuberances can become specialized as organs of defense. Below, the trunk of the "Monkey-Puzzle" Tree, showing hair thorns



(Below) CROWN-OF-THORNS PLANT (*Euphorbia splendens*). Long spines projecting from the stems protect the leaves, which are the food factories, from the appetite of herbivorous animals. In these and many other ways the citizens of the plant world wage their passive yet vigorous war against the animal kingdom



early leafing time? Such a look is bound to seal the thorn's identity as being a true branch, for from its surface may be seen in strict foliage arrangement minute leaves which, later in the same season, will drop leaving only scars as reminders of their presence. Tiny breathing pores characteristic of woody plants and known to the student of botany as lenticels may often be found on such thorns. There seems then to be ample proof that this type of thorn is a form of modified stem.

Stem thorns, like the weapons that they imitate, vary in efficiency; some are coarse and bludgeon-like . . . little changed from the original branch form; others become like the hawthorn—needle sharp and rapier pointed; the best of all become branched and thus can guard against danger originating in several directions.

An example of the origin of the stem thorn type may be seen in any old abandoned apple tree. How many of us as boys or girls have sought to ascend into the gnarled branches of such a tree only to find the way beset by crude stem thorns? Various other members of the rose family . . . pears, peaches and plums, when they are permitted to "run wild," frequently assume this thorny nature, perhaps to offset the lost protection of man. Given a long enough period under such wild conditions—the infinite length of time demanded by organic evolution—our stubby apple tree thorn might follow through the ages the path blazed by its cousin's thorn, that of the hawthorn. Here is a superior sword made in Nature's Damascus foundry. In tensile strength and sharpness a better weapon could not have been devised. For usefulness better shapes have been invented. Honey locusts possess thorns which are branched and it is easy to see that such branches guard this species against dangers arising on either side. This is a distinct advantage, for unlike a motile gladiator, plants cannot swiftly move single-bladed weapons in a variety of threatening directions.

Size

Stem thorns vary much in size; amongst the hawthorns they measure from one to three inches. They are longest in certain of the thorn-bearing species native to the Argentine pampas where it is said that forest species with weapons up to twenty-five inches in length are not uncommon. Their usefulness to the plant as a protective device is reflected in the respect of the ranch owners of those districts. These men fence in such thorn thickets to insure their cattle against the terrible wounds inflicted by such formidable weapons.

All the leaf-bearing branches of a plant are not always thorn producers and hence there can be on

plants unprotected areas. Areas of this kind are usually well above the ground for it is characteristic of most plant "dread-noughts" to carry their weapons close to the source of danger, cattle on the ground. Individual species there are whose leaves even hide the thorns . . . in other words the foliage is outside of the protection needed. Here protection is not wholly wanting for it is interesting to note that at the time of year—spring—when leaves in deciduous plants are at a premium because of small size and hence small food manufacturing ability, they are totally protected for they have not attained sufficient growth to push them beyond the bristling thorn guard. When growth does push them beyond the portals of a safe haven there is enough volume of leaf surface to permit the sacrifice of a few leaves to the cause of an animal's empty stomach. It can be often noted that thorns are more frequent on the young plants of woody thorn-bearing species than on the mature specimens, the possible reason being that youth is a period of easy prey, a period which vanishes in the appearance of lofty branches and a thick and corky trunk.

Porcupines of the plant world

All stem thorns do not take the rugged sword-like form characteristic of the types thus far mentioned. Sometimes nature finds that a needle-like type has a distinct advantage. Nowhere is this form better seen than in the great cactus family. With leaves reduced to the minimum and all the food manufacturing relocated in the green tissue of thick succulent stems, protection, too, must be centered in these regions. When you next view a cactus, notice the beauty of its armor coat, whose thorns range from needle thinness to stubbiness. Sometimes they are arranged in vertical files, at other times they spiral or circle around a much compressed stem to give the appearance of living desert pin-cushions. Primitive man has not allowed such weapons to go long unused and has, in remote portions of the globe, often turned such needle-like swords into the "ploughshares" of his wife's domestic sewing basket.

Variety in armament is the spice of the cactus life. Stem thorns in this group may be found long or short, thick and thin, knotty and smooth, straight or barbed pointed, arched or wavy. Nor is a given species limited to one type for individuals may frequently be found with an assortment of two or three kinds. The *Opuntia* clan is the best example of the latter for on their flat rabbit-ear stems appear two thorn types. The longer one is a typical needle-like spine; in its smaller size the other one camouflages a multitude of inherent viciousness. Under a microscope we can easily see the reason for their effectiveness.

ness. Spiraling down from the acicular tip are rows of fine retrorse barbs which make a single one of these tiny *Opuntia* thorns the best of fish hooks, for let them but touch the skin of an animal and, porcupine-quill-like, they detach themselves from their parent body and begin a progress through the host tissue, as easily navigable as is wood tissue by the action of a bit. This penetration causes the familiar smarting sensation common to all who have, by chance, run up against a cultivated *Opuntia* cactus.

In the columnar or organ pipe cactus forms typified by the various *Cereus* and related species, divergent thorns lined up along vertical parallel ridges survey and protect the valleys, or grooves of green tissue lying between. Similar forms are assumed by various African *Euphorbias*, close imitators of cactaceous grotesqueness. Were one of these elongated cylinders pushed at either end and conceivably telescoped, the result would be a beautifully compressed pin-cushion on which the pins would be the stem thorns all lying on radiating lines.

Someone may ask, "Would animals like cactus tissue if unguarded?"—in other words, is armed defense in the desert really necessary? To this we make vigorous affirmation for our wastelands support few plant species and so the only choice to the herbivore is the cactus morsel. The hunger urge is at times even greater than the fear of consequence and we have record that even the genus *Melanocactus*, blessed with frightful spines, has been sought after in periods of drought by the wild asses of South America. These poor creatures often root up the base with their hooves in order to lay bare the lower unarmed succulent stem and have even been known to attempt splitting the armed aerial portions, often receiving for their efforts dangerous wounds.

Forbidding leaves

Stems, as thorns, are not the sole protectors of the green plant body. Leaves often guard themselves and by so doing bring defense right to the usually defenseless factory. Their ordnance methods are as varied as are those of the stem. Like stems, they frequently turn their tips from formless flatness into the keenness of a to-be-guarded-against point. If all the leaves of a plant effect such a change we admire, at a comfortable distance with the beasts of the field, such species as *Agaves*, *Aloes*, and *Yuccas*, for here leaf points make an impenetrable barricade. All the body of the leaf has been closely bound into the formation of the sword tip. Some leaves have only the extended midvein thus armored.

To make war more gruesome human munition makers devised swords with saw-toothed edges. A

million years ago nature forecast such in the blade edges of grasses, sedges, and even of our just mentioned succulents. How often have we cut ourselves on grass leaves exclaiming that the blade was sharp without realizing that the microscopic reason for its sharpness was a multitude of razor-edge serrations, the better to cut the sensitive mouth tissues of their intended murderers, cattle. Such serrations are formed by the repeated extension of the tiny leaf skin cells which, after length is reached, harden off to better their cutting ability. In the southern European Alps the saw edges of *Festuca alpestris*, an Alpine grass, are so well developed as to often severely wound the nostrils of grazing animals. The margins of leaves are not always regularly serrated like those of grasses. Of irregular length is the assortment of thorns typical of the leaf of the thistle. Despite such disparity in size and arrangement, the end in view . . . protection . . . is always maintained.

Evolution of plant defense

Evolution often achieves remarkable changes. In all the preceding leaves armor was secondary, food-making primary. Some leaves have been so modified that, like the highly evolved thorn branches of the honey locust, their original function (food making) has been made subordinate to that of protection. No one who scans closely the sucker shoots of the common barberry (*Berberis vulgaris*) can doubt the plausibility of the whole evolutionary concept, for here, running up the shoot is a whole series of progressive transformations starting at the bottom with normal barberry leaves which grade almost imperceptibly into the triradiate thorns of the stalk's summit. Midway on this evolutionary ladder are organs—half leaves, half thorns—caught in the act of change.

Nearly any part of a plant's body can give rise to those tiny protuberances which, for lack of a better name, had best be called hair. Hair exists in a variety of forms; a botanist merely opens his mouth and hair becomes pubescent or puberulent, hirsute, or ciliate, bristly or glandular. Its variability makes it serve a great number of purposes, one of them being protection. Unlike many another transformed organ hair may be told by its irregular arrangement on a stem. It may occur in scattered tufts or may cover in totality; in its original condition hair is soft and thus prevents wilting as an anti-evaporating blanket retaining the all-necessary moisture in underlying tissues. It does not keep plants warm. When soft and plush-like it is difficult to believe that hair can be an agent of protection against animals, and yet in the common mullein it is. A microscopic look at one

of this plant's leaf hairs would leave with the investigator the impression of a miniature fir tree, so branched is it. Such hairs easily detached find their way to the mucous membranes of any animal bold enough to try such a mullein morsel, and once tried that animal says, "Never again!" Man has long respected this characteristic of mullein and whenever he has made use of its leaves for tea, the hairs have been carefully filtered out before drinking.

"Petrify" a single soft hair and the result is rigidity and sharpness combined in a prickle. Such a form is better for defense than a soft hair and, cognizant of this, nature has made much use of it for

inflicting punishment. One takes a sporting chance on coming out "whole" when picking raspberries or blackberries. Think of the trouble a cow would get into if she tried to wade through such a barbed wire entanglement. The whole tribe to which these berries belong just bristles with defense, and counts for their side hundreds of unpicked roses to the few which beautify Milday's boudoir.

Defense then by means of thorns, barbs or prickles is a vital and almost universal provision in the "foreign policy" of plants, and any survey will show that the development of it runs into the anatomical millions.

WHAT ARE THEY THINKING?

Continued from page 89

out—intriguing, fascinating and highly instructive in every way.

I have tried to show that at least a superficial knowledge of psychology, anatomy and behaviorism are all part and parcel of a *must-be-acquired* equipment which should be carried along on your life adventure in this rather strenuous field of endeavor. Even our own behavior is made up of so many attributes that we fail to realize the infinite complexity of every movement or analyze the brain stimuli which produce an emotional response. So it is with the whole world of animate creation—mind and body being inextricably mingled to create the thing we call a living creature. How very important it is, therefore, to make an intense and careful study of all the different factors that enter into the make-up of the particular animals we may wish to portray. Without a fair amount of knowledge on the subject our work will be sadly lacking in character, wishy-washy and devoid of interest both to ourselves and to the world in general.

All art work should be undertaken as a joy and a pleasure, not as mere drudgery but as something very absorbing, extremely interesting and remunerative, at any rate esthetically if not in a practical way. To explore even a few of these mysteries from whatever point of view most appeals will surely demonstrate very convincingly the joy of deeper understanding of Nature's story—a bit of truth and knowledge that we may call our own.

ARUBA, CINDERELLA OF THE CARIBBEAN

Continued from page 140

ground of incandescent shades, one is reminded of the forge of Vulcan, set at the bottom of Vesuvius in the imaginative Greek mythology.

Thus Cinderella has come into her own!

Wealth has come to the most dejected of all the isles of the Caribbean. Where its own resources had failed, its fortunate geographical position scorned by the early explorers, succeeded.

The world comes to Aruba

Oil men from every state in the Union work in the refineries and almost every nation of Europe is represented. West Indian laborers speaking a conglomeration of dialects flocked to it and are corralled in a quaint village of their own back of the tank farm of the Pan-American; St. Nicolaas resembles a frontier town of the old American West; Oranjestad imports silk stockings from Paris, canned goods from the States, curios from China. And where once upon a time only a few paltry goat hides were forthcoming, the Dutch Government is making big sums on the income tax foreigners must pay.

Will this wealth prove to be just a boom like the Yukon with its gold, like Manaos with its rubber, like Tampico with its oil? Perhaps. Nothing is eternal in this world. But while its lasts, Aruba, the unfortunate, ill-favored little Cinderella, is queen amongst all her sister isles.

THE INDOOR EXPLORER

Totem Poles, Totemism Today, and Tammany's Tiger

If the little box of small type which American newspapers reserve for British professional football scores has ever given you pause you must have noted the characteristic restraint, the native conservatism, that is revealed in naming these various teams. In our country, the names of professional athletic clubs bristle with such colorfully fearsome designations as the Detroit Tigers. But despite their tolerance of the lion as a national emblem, Englishmen prefer the guarded simplicity of just plain Birmingham, Notts Forest, or Aston Villa in their athletic teams. Occasionally, almost universal qualifications like "Wanderers" and "Rangers" crop up, but that is as far as your Britisher seems willing to go.

The foregoing idle speculations were farthest from the writer's mind when he trudged a trifle apprehensively among the gigantic totem poles that glowed down upon those visiting the Museum's Hall of Northwestern Indian Life. But later, upon investigating the story behind these remarkable wood carvings, a link between totem poles and professional athletic nomenclature became apparent. Totem poles, of course, represent the work of the Northwest Indians, who populated a section that only a few decades ago was the farthest frontier of America's westward development. Now anyone who has followed Dr. Clark Wissler's reminiscences of the earlier Indian reservations* has seen the tragic portrait of a people rapidly losing their ancestral culture under the impact of white civilization. But conversely the Indian has lived his life in our midst all too recently for us to suppose that our own culture never adopted certain characteristics of his. That we have formed the peculiarly American habit of giving animal names to our baseball and football teams, seems to your Indoor Explorer a clear case of the Indianization of our culture. Animal names are so liberally sprinkled throughout every phase of Indian folklore that it is just as reasonable for Americans to take over much of their nomenclature as it is for Britishers, with their markedly different background, to be only very slightly affected.

But before we indulge in further scrutiny of our present-day culture with reference to its Indian antecedents, we had better establish once and for all what a totem pole is—and what it is not. In the first place, it is neither an idol nor a god. So many people after inspecting this Hall have gone away with some such understandable but false impression that it seems fit to scot the notion at outset. The assorted animal life clearly defined on these poles beguiles you into regarding

them as the work of a people who worshiped animals, but you're wrong. The red men believed they were descended from animals; that these animals could understand what was said when they were spoken to. But the Indians did not deify them.



The closest analogy to the totem pole in the life of white men is the heraldic crest or family coat of arms. Once suggested, the outward similarity becomes obvious. Both are made up of animals, real and imaginary, or plants. The lion rampant, the eagle, the unicorn, the oak tree, the lily—all these are familiar to us in crest decorations. But while the flora and fauna of the older crests have little individual significance other than legendary, the animal carved on a totem pole often played a very active and fundamental role in Indian life. This was especially true if the animal so represented was a totem-animal... a term to conjure with in almost any primitive society.

Somewhat like the animals of the zodiac for the astrology-minded people of our own day, each totem-animal was a symbol under which a group of Indians was born. But this symbol had little to do with occult character analyses. It symbolized a sub-division of the tribe—a clan or caste. As illustration, take the entire native population of Southeastern Alaska. This considerable body of red men was divided into two great totemic divisions known as the Eagle and the Crow. The Eagle and the Crow were the primary totem animals, each repre-

senting a clan. But such was the structure of this Indian society, that it could not get along with just two totem animals. Accordingly, each main totemic clan had several sub-divisions within itself called sub-totems, each having its own totem-animal. The sub-totems of the Eagle clan were the Bear, Wolf, Whale, Shark, etc.; while those of the Crow were the Beaver, Frog, Salmon, Seal and so forth. Did this system of sub-totems simply indicate a tendency toward decentralization? No, far from it. When you were born under a certain totem, the ancient law of the tribe forbade your marrying anyone born under the same animal. Nor were the Crows one large group of families set off from another large group called the Eagles. *Every family in the entire tribe must be both of the Eagle and the Crow clan.* The husband a Crow, and the wife an Eagle, or vice versa. Here is no decentralization—the system makes for the closest imaginable tribal unity. Given this foundation and the law that you cannot marry within your own natal group, it is easy to see how the sub-totems developed. Any one of the Crow line of sub-totems could cross over to sub-totems of the Eagle division and seek a mate, or the reverse. But no one of the Crow line could take a partner in marriage from any of the sub-totems of his own division *even though the object of his desire was an utter stranger and no blood relation whatever.* This is the fundamental law of the totemic system which with certain exceptions was in force throughout all North American Indian society. But the totem poles as we know them in the Museum, far from being widespread, were created only by the Indians of the Northwest. Why? Just look at the size of them. They could have been made only by a people living among very tall trees, specifically the cedars of the Northwest stretching from Humboldt Bay in Northern California to Yakutat Bay in Alaska.

Now suppose we examine a typical family totem pole in its completed state. We will find engraved on it the hereditary totem-animals of all members of the family, that is, the father's totem and the totem belonging to his wife and children. As is not uncommon among primitive people, inheritance passed through the mother, and the children would, therefore, be counted as members of her clan. But the two totem-animals are not all you will find. Somewhere in a prominent position on the pole there is likely to be an animal which has nothing to do with the genealogy of the family. For the totem pole, speaking figuratively, thinks nothing of departing from its original function of family crest and taking on other duties. Which is not hard to un-

*Eisewhere in this issue; and in the May and November, 1937, issues of NATURAL HISTORY.

derstand when you consider that the totem pole offered these Indians the most important available means of self expression.

Besides his family crest, the white man had his literature, and his marble tombstone—media through which he could immortalize the stories he loved and commemorate the names of his dead. These Indians had no literature. They did not have any marble or granite, or the tools to work them, but they had those towering cedars and they made the most of them.

Reverting to that apparently uninvited animal guest on the totem pole we find that he turns out to be a raven (a fairly common figure in the Northwest). And if we were to browse about a little, we'd come across other ravens on other family totem poles. For the raven (a personified animal ancestor) belongs to the tribe as a whole. His effigy on their totem poles serves to remind them of the legendary benefits he bestowed upon his people. (He stole the moon, for one thing, and fixed it in the sky so that all his brothers could have light at night.)



The stories of the different animal characters depicted on the totem pole were innumerable. They served as a sort of *dramatis personae* for all the tribal legends and it is not hard to see how they provided a quasi-permanent framework around which the tribal "literature" was reconstructed for each successive generation. You can picture the curious questions of the Indian child as he stared up at his awe-inspiring "family tree" and imagine him looking forward to the nights when the family gathered around the campfire to tell tall tales, part family history, part legendary folklore. He would remember these tales and adding perhaps a few variations of his own, would tell them to his children when he grew to manhood.

When they turned these great cedars into mausoleums or commemorative monuments, the Haida, one of the tribes in this region, employed three types of construction. First, was the slender memorial pole, carved and decorated with legendary or genealogical figures. If a decorated box containing the body of the deceased were to be placed on top of such a pole, it became another form, called a "grave-father." This could be varied by having two poles support a larger box capable of holding two or more bodies called a "double grave-father." The third version, also called a "grave-father," consisted of a single pole channeled out at the back in which the body was inserted and subsequently sealed within by boards built over the opening. Your Explorer need hardly add, in view of such customs, that the silent, gloomy burial ground was usually located far from the village, preferably on some lonely coast or promontory.



The Indians, not only carved family crests, legendary ancestors, and commemorative tombstones, but such giant war canoes as the one exhibited in the Northwestern Indian Hall were wrought out of trees by these people who lived in what might well be called a "Cedar Civilization." Although they had worked in cedar with enviable dexterity long before the days of the white man, it was contact with the white traders, oddly enough, that ushered in the greatest and most prolific artistic period in their history. A stone tool was a far better implement than modern man is apt to think, and these Indians had developed all their basic art forms through its use. But when they obtained the steel adze and the sharp curved tools of the white traders they were able to enlarge greatly on their previous accomplishments. Thus it was not until after the white traders had penetrated the Northwest in appreciable numbers that totem poles of the heavier and more intricate type came into being. It is from this latter variety that the Museum's collection is chiefly drawn.

When judging their age, we usually fail to discount the exposure to rain, wind and other elements which rapidly gave them an effect of great antiquity. The fact is that they are not really very old. Most of them were produced during the steel-tool artistic "boom" (about 1840 to 1890) and one or two were wrought as recently as the early part of this century.

However, when you turn from totem poles to the social institution called totemism, you will find yourself prying into the most ancient laws of the race.

Totemism goes far back beyond the dawn of history. In its broadest significance it is a milestone on the path of human evolution past which every cultured people has marched en route to civilization—in short, instances of its practice have been found the world over. Totemism is a paradox. It is at once man's most primitive religion and his earliest form of large-scale social organization. To the modern mind, this will at first seem a strange coincidence, but it must be remembered that totemism was in operation long before anyone had thought up such an idea as "the separation of church and state." The religion of totemism was a functional religion closely interwoven with the material life of the community. It was not something in which you professed belief while pur-

suing another altogether different line of action. Not only the spiritual, but the everyday physical life of each person was governed by its unwritten but inviolable taboos. Thus church and state, as the savages knew them, were one and the same thing—inseparable because they formed an indivisible unit without joints or seams of any kind.

From the viewpoint of contemporary totalitarian dictators, totemism must be acknowledged the most satisfactory social institution ever devised by man. And if these gentlemen are looking for new ideas as well as deep-seated historic precedents for those already in circulation, your Explorer can heartily recommend an exhaustive research into practical totemism.

In our discussion of totem poles it was pointed out that the Indians did not worship these structures as idols representing animal gods. This is in line with orthodox totemistic procedure everywhere. For (and here is another paradox) a totemic people will never pray to a totem animal. They will declare that the animal is their ancestor. They will ascribe to it supernatural powers. But animal worship proper, as practiced by the Hindus, for example, and totemism, are two different things.

We may safely conclude then, that the North American continent has never been peopled by animal worshippers. But anyone who thinks we saw the end of totem animals and their clans when the last sizable body of Indians was swallowed up by the white man's reservation, had better cast his eye over the following list of secret societies that have flourished among American business men during the last two decades. There are the Red Men (who meet in Tribes), the Stags (who meet in Doves), the Owls (who meet in Eyries), and, rounding out the animal kingdom, the Beavers, Lions, Serpents, Roosters, Orioles, Deer, Geese, Goats, Bears. Beyond these are the magical fraternities of the Concatenated Order of the Hoo-Hoo, the Iridescent Order of the Iris, and the Benevolent Order of Monkeys.



Although several such societies were decimated by the depression years, it was estimated, at the census of 1926, that of the 60 million adult people in the United States, 30 million belonged to 800 different secret orders, many of them bearing animal names like the "Elks," one of the oldest, largest and best known of the type. Since 30 million by far exceeds the number of Indians calculated by anthropologists to have lived on this continent in the flower of their culture, it is quite within the realm of possibility that there are more "totem animals" influencing the life of contemporary white men than ever figured in the apogee of the Indian clan system. Despite the fact that a large number of these secret societies were organized from business motives, they are largely philanthropic in function and do not govern the every act

and deed of the members as did their Indian predecessors. But it is interesting to note the survival of certain totemistic customs in the life of the secret societies of our day.

It was recently reported that during a National convention of the Lions Club in California, a real, genuine lion was killed, cooked and served as one course of the main banquet. After quizzing some of those who participated, *Life* magazine stated that the meat tasted like veal and that two guests got sick. This latter fact might strike some as a visitation of poetic justice. For in most primitive totemic tribes the killing for food or other purposes of the totem animal was definitely taboo. In Australia, where many anthropologists feel that totemism is practiced in its original and therefore "purest" state, the natives, although they will never harm the totem animal themselves, often make a practice of cultivating it to a certain extent and helping their friends belonging to a different totem clan to capture the animal for food. This operates as a reciprocal arrangement probably brought on by economic pressure. But anthropologists have observed a curious aberration from this taboo which takes place on certain festival days. Although the savages belonging, say, to the Kangaroo Totem, will religiously forbear to touch that animal in the ordinary course of events, they hold feast-days on which the Kangaroo is butchered and eaten amid much primitive ritual and ceremony. Here, apparently, we find a parallel to the activities of the Lions Club convention. It is unlikely that this order has promulgated a taboo forbidding its members to kill lions throughout the year, as such a step would hardly seem necessary. It is also unlikely that the slaughter of a lion on feast days is a regular custom. But in this one instance, at least, the members followed the historic precedent of their Australian counterparts.

Although unprotected by taboo, there is evidence that the "totem-animals" of present day secret societies are treated with a certain reverence by the members. Taking the Elks as an example, we find that in its infancy this society chose the elk as a symbol because of his allegedly exemplary social habits. The original Elks believed that their "totem-animal" treated his wife and children with utmost kindness and was unflinchingly brave in their defense. While this may well be true in certain instances, there is ample evidence that the elk cow does her full share in protecting the children as well as herself. Furthermore, elk bands almost invariably have *elderly females* for their leaders. One can picture with what collective alarm the B.P.O.E. would receive the news of some unswerving fundamentalist rising up in their midst and taking the stump for an elderly female leader. As a further note on its exemplary social habits, your Explorer is compelled to mention that the elk is considered the most polygamous deer in America if not the world.

This tendency to seize upon some admirable trait, real or imaginary, in the "totem-animal" and to employ it as a sort of symbolic motto seems to be the distinguishing characteristic of our "modern

totemism." And it is this characteristic that marks it off from its antecedents in primitive culture. The Indian may have claimed the Eagle for an ancestor, but it is very doubtful that he thought of himself as inheriting the bird's vision or its power of flight.

Totemism today is more akin to the witches' brew—a draft of which would instill in the drinker the characteristics of the various animals boiled down in the cauldron. Thus when the Detroit baseball club calls itself the "Tigers" it implies that its operatives are going to tear the rest of the league to pieces with the ferocity of the "totem-animal." Similarly, such venerable educational institutions as Princeton University with its tiger, Yale with its bulldog, and Columbia with its lion signify their intention, figuratively at

least, to mould their young men in the behavior patterns deemed most admirable in their respective "totem-animals."

Of course, the American tendency to adopt totem-animals and organize societies after the Indian methods goes back at least as far as the French and Indian War. The frontiersmen at this time and later during the Revolutionary War were familiar with the ways of Indian life and naturally took over many of the more appealing customs. There is, for instance, a curious mingling of Indian and European culture in the famous society called the "Sons of St. Tammany" which flourished around the time of the War for Independence. The Tammany, who was thus canonized, far from being an early church father, was a chief of the Delaware Indian tribe whose reputation for

Continued on page 160



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DIARY (1751-1752) • THE SPOTTED LION • RED DEER

ANIMALS AND MEN: Studies in Comparative Psychology

— by David Katz

Longmans, Green & Co., \$4.00

IN recent years several excellent textbooks on animal psychology have been published in English. Since at least two of the American texts are encyclopedic in scope one might assume that there was no room for another summary of this field. It is, therefore, a very agreeable surprise to find that in this comparatively thin volume of only eight chapters and 263 pages Doctor Katz has brought together an array of interesting facts which have either been ignored or inadequately treated by other interviewers. Much of the work he discusses was carried on in his own laboratory or in other European laboratories available to him. The book is written with a charm of personal contact which would be lost in a larger volume.

The chapter devoted to the spatial relations of animals reviews the recent experimental work on homing in birds and dogs. The chapter on the social psychology of animals summarizes the recent studies on "pecking orders" and social bonds in the animal community. Although many original suggestions appear throughout the book, the section devoted to the nature of appetite is elaborated into a new and well supported theory of broad significance. Beginning with such established facts that certain insects have been induced to change their food plants and that this change was inherited, Doctor Katz develops the thesis that it is the chemical modification induced in the protoplasm of the egg which has called forth a changed appetite in the adults. Similarly all appetites, while subject to modifications through training, are ultimately due to different chemical constitutions.

Throughout the book emphasis has been laid on what animals and men have in common. The instinctive acts of animals, like those of man, have a strong emotional accompaniment, but enjoyment and satisfaction of particular needs are closely bound together in animals. Man, on the other hand, is able to separate pleasure from the natural basis and make it an end in itself. This leads to various difficulties which Professor Katz considers briefly in the last chapter.

It is noteworthy that most of the experiments discussed and often figured by Professor Katz have been conducted with a minimum of apparatus. There is very

little reference to mazes or problem boxes which dominate most reviews of animal psychology. In brief, the book is not only refreshing in its originality, but it contains much of interest for the students of both animal and human behavior.

G. K. N.

THE ISLAND OF BALI: With an album of photographs by Rose Covarrubias

— by Miguel Covarrubias

Alfred A. Knopf, \$5.00

THE ISLAND OF BALI of Miguel Covarrubias blends research and understanding into a full and detailed description of this delightful island. Mr. Covarrubias' drawings and his wife's exquisite photographs bring out the rich details of the complex ceremonial which surrounds social life in the island. Two



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periods of residence enable this gifted couple to write a definitive book on the Balinese, which bears the greatest interest for the traveler, the general reader, and the social scientist.

The book begins with a geographical description of the island and then passes on to a survey of its history. Mr. Covarrubias next describes the social organization of the community and its economic structure. Daily life and the social composition of the family are reviewed and art and drama receive a searching scrutiny. The second part of the book covers the nature and practice of the highly ceremonialized religion and contains a chapter on witchcraft and magic which so often accompany a complexly organized formal ritual. The elaborate ceremonies attendant on death are the subject of another chapter, which fitly is the apex of the book. The author concludes with an analysis of the future of Bali which clearly brings out the irreconcilability of West European civilization with other less mechanized types of culture.

The scope of the book is, therefore, broad, but the treatment is descriptive, albeit sympathetic. *The Island of Bali* can be read with the severe attention of the scholar, who will find the organization excellent and the sources listed in orderly fashion. On the other hand, the browser can steep himself in the exquisite photographs by Mrs. Covarrubias or the enchanting drawings of her husband and pass by easy stages into the text, which is always written humanely and is conspicuously free of the bald and arid treatment of the professional technician. It is perhaps the best accessible account of how people live under the complex conditions imposed by a complicated social system, an incredibly involved religion, and a highly ceremonialized art. Such situations are common enough to art students or archaeologists, but seldom do they have the chance to see, as in this book, how the system really works.

The Island of Bali is the kind of book that one likes to keep by one for occasional reading and reference. I can think of nothing better for a round the world cruise. Also it should provide a series of ideal texts for the teacher of anthropology and sociology. Mr. and Mrs. Covarrubias have accomplished a very difficult task in assembling so much material and without their special talents, it is hard to see how the book could fulfill so well the very different needs of the specialist and of the interested traveler.

GEORGE C. VAILLANT.

MEXICAN INTERLUDE & NOTES ON A DRUM

— — — — — by Joseph Henry Jackson

Macmillan Company, \$2.50 and \$3.00

MR. JACKSON has written two delightful books, *Mexican Interlude*, which describes a trip to Mexico over the Laredo highway, and *Notes on a Drum*, which covers a more extensive trip to Guatemala. Both these books give a basis for the casual traveler to formulate his impressions by describing simply and well the scenes the two countries have to offer. Delightful photographs by the author add to the charm of the books and prove his great descriptive gifts by matching neatly the scenes he retails in his text. This singularly happy combination of pen and camera is all too rare in the travel books of the present day.

Mexican Interlude covers the crack motor trips in the Republic of Mexico, the long haul from the border to Mexico City, the drive to Tlaxcala and the state of Puebla, and the territory along the highway to Cuernavaca, Taxco, and Acapulco. Mr. Jackson brings out the extraordinary differences in terrain, in people and in mode of life that impresses so deeply the traveler to Mexico. If the reader has not been to Mexico, Mr. Jackson fairly whets the appetite; if the reader has been there, the author recalls vividly familiar scenes and brings into sharper focus impressions half remembered. Mr. Jackson skilfully avoids the morasses of historical background to keep on the hard ground of what there is to see.

Notes on a Drum does the same sort of thing for Guatemala. This book shows definitely the effect of the author's previous Mexican journey, since it gives him a reference point to make comparisons in describing this smaller republic. His descriptions of his trips through the Highlands of Guatemala are more intimate and reflect the letters of introduction which gave him access to first-hand information. Yet, there is no loss of Mr. Jackson's fresh and vigorous descriptions and his appreciation of the minute detail of Indian life in the Twentieth Century.

These honest travel books will make an excellent supplement to the reading equipment of a visitor to Mexico and Guatemala. They will also provide excellent reading for him who takes his voyages vicariously. *Mexican Interlude* and *Notes on a Drum* delighted this reviewer, whose professional acquaintance with the two countries tends to make him acid about travel books on the region. Mr. Jackson's complete simplicity, combined with his vivid, easy descriptions, make these two books stand out among their fellows as ideal introductions to two fascinating countries whose charms are apt to elude visitors without a preparation of this kind. Let us hope that Mr. Jackson will return to write again. He has true appreciation and understanding.

GEORGE C. VAILLANT.

A Welcome Gift for Any Child
JUNIOR NATURAL HISTORY
Published by

The American Museum of Natural History

THE DIARY OF A SURGEON in the year 1751-1752

— — — — — by John Knyveton

Edited by Ernest Gray

D. Appleton-Century Company, \$2.50

MORE action than the modest title and eighteenth century illustrations of this chronicle suggest, fills John Knyveton's first year as a surgeon. London welcomes him with cutthroats, body snatchers, dueling, disease, and sawdust. One of his early successes with his prized ivory-handled lancets ends with the suicide of the patient. As surgeon's mate of H.M.S. *Lancaster*, he finds the routine of the sixth-rater varied by press gang raids, flogging, mutiny, desertion, spar-cracking tempests, romantic love on a tropic isle, French men-o'-war, oranges and the Flying Dutchman. Rape, riot, pestilence and death crescendo to a climax in a blood and brain dripping battle with pirates. Homeward bound, he is left on an island drummed into delirium by revolting slaves, voodoo, yellow fever and human sacrifice.

Lost on the Atlantic, Knyveton complains only that some poor wight has crushed a cockroach over the most important part of the map; but on intellectual seas he is not only lost, he is completely bedevilled. Nor by Doctor Samuel Johnson's London dinner or drink or dictionary is he struck dumb, but by dialectics. The principia of his contemporary physicians paralyze this disciple. The theory of theologians descends upon his mind like night. Even such a curious character as Mr. Kelly with his Microscope befuddles John for the rest of his life. His "spirit" is never at peace.

Would it be any more at peace today? There is less tar on the hot iron of surgery. There are better microscopes than Mr. Kelly's. Fewer captains drown in rowboats. *Mycobacterium leprae* instead of too much Rye Bread, tabs leprosy. Science ever more quickly heaps up factual food that nations cannot digest—even with Doctor Johnson's alphabetical digestion. Fewer cockroaches but only the same old oceans on better maps. Wonderful oranges, but fundamentals still too much like fudge. Surgeon, scientist, sociologist. . . . What true physician will chart our course?

RANDOLPH BARTON, M. D.

THE GARDEN IN COLOR

— — — — — by Louise Beebe Wilder

Macmillan Company, \$7.50

ANYONE requiring encouragement in the desire to have a flower garden of their own will surely get the urge by glancing between the covers of Louise Beebe Wilder's new book, *The Garden in Color*. The alluring photographs in natural color and Mrs. Wilder's charming word pictures transport you into her seasonal descriptive-gardens and give you a longing to make Mother Earth do for you such things as are portrayed as possibilities in the book.

Many of you are no doubt familiar with Mrs. Wilder's other books on gar-

dening or her interesting articles that have appeared in the *House and Garden* magazine, and will welcome this finest of her efforts to assist in making the gardener's experimental pathway smoother.

The book is divided into sections with suggestions as to appropriate evergreen plants or seasonal bloomers for Spring, Summer, Autumn and Winter gardens. Under the Winter section we find not only the treatment of outdoor gardens but "The Garden Under Glass," where Glaxinia, Amaryllis, Bird-of-Paradise, Cuckoo-pint, Bead Plant, Croton, cactus and orchid vie with each other as enticing possibilities for an indoor garden when the wintry winds blow outside.

Another feature of the book is suggestions for flower arrangements, per se, sons, illustrated in color.

The experimenters are giving, from time to time, an ever improving means of reproducing natural colors. In this book the 350 color plates of flowers, gardens, parks and flower arrangements have reached a new high in accuracy. The ever elusive and infinite variations in the shades of green have been, and still are, the color photographer's bane of existence, but in many instances the publishers have been able to give very true color tones. The results are so pleasing that as you turn the pages the superb plates give one the feeling that they should be taken from their hiding between the gay green covers, framed and hung up for all to enjoy.

But aside from its being beautifully illustrated, this book will be of very practical use to those who wish to start their own gardens. Correct habitat, soil preferences, proper groupings as to rapidity of growth or pleasing color combinations are given in the discussions about each plant. Both woody and succulent plants accompanied by scientific and common names, information as to the history, native home, parent plants from which they are derived or other interesting and useful data are included.

FARIDA A. WILEY.

THE SPOTTED LION

— — — — — by Kenneth Gander Dower

Little, Brown & Co., \$3.00

BOOKS about Africa seem inexhaustible, but Africa, with its vastness, is inexhaustible. Our author, who starts from England to see a land which he has heard so much about, frankly admits he has no qualifications for a life on safari. He is neither an explorer nor a hunter, hardly knows which end the gun goes off and has little knowledge in photography.

An Oxford man, who is an expert at tennis and cricket, which has made him fit, he goes forth to this land on a jaunt with no particular objective, but "discoverers" to his surprise that Africa is still a primitive land, that it is not "shot out," and that it is still a wonderland with much to offer if one but cares to look for it.

Gander Dower's sympathetic nature unfolded to him many interesting things which the traveler, and even the rather obtuse hunter, never senses. He subtly

describes the "Afrikander," who is perpetually at odds with the government. He paints very true and colorful character pictures of the settler and official, as he finds them. Even his native boys, whom others kick about and abuse, he finds interesting and speaks most amusingly of the strange workings of their primitive minds, sometimes putting the shoe on the other foot and cleverly painting the white man as they see him. With all the subtlety of a gifted pen and a very able and delightful command of English, he writes of his jaunts over plain and forests, seeing not what the traveler would see, but feeling the soul of the country, its beauty, its wonder and its awe. Only to the true lover of nature can so much unfold, and it is fortunate for us that the author was blessed with so fine a talent for writing.

His first experience is on safari on the plains. He speaks little of this, for it appealed little to his sensitive nature. The mere killing of game interested him not at all, and he soon left this life, but not before he was overpowered with the desire to go alone out into an African night. This is a high spot in the book. By many who have never had such an impulse he will be considered crazy for the thought and act, but those who know Africa or know that pull which draws one into the solitude of nature will understand and be thrilled.

Later, with a settler friend who lives at the foot of a mountain range, Dower goes in quest of the "spotted lions," which are said to live high in these mountains. These lions have been heard of and occasionally seen by natives. Only two skins exist, no skull or skeletons, so scientists cannot say whether they are different or not. Gandar Dower and his lovable companion organize a safari to penetrate very high and cold uplands, only known to natives. Here their experiences are equal to those of pioneer explorers, but it is the delightful and amusing way he tells of discouraging defeats and happy, but temporary, successes that makes the story.

To say the book is beautifully written and well worth reading is putting it mildly. Once you start it, you will not put it down.

JAMES L. CLARK.

A HERD OF RED DEER: A study in animal behavior

— — — — — by F. Fraser Darling
Ph.D., F.R.S.E.

Oxford University Press, \$5.50

THE author, in his study of the Red Deer, worked over the more remote Scottish deer forests and watched their habits daily throughout the seasons of the year. To this study he gave his undivided attention, a great deal of time and patience.

The great majority of works on animal behavior are derived from artificial settings and the results are not always true interpretations of representative conduct. Doctor Darling's work presents the most complete study of the normal behavior of a race of animals under natural condi-

tions that I have seen. He made a systematic study of the territory visited and its population. Some very important facts are brought to light that will be of special interest to those concerned with the conservation of wild life. The author points out that antlered game subject to pursuit by man are particularly in danger of extermination. The mature animals, including those with the best antlers, are the first to come into rut. He states that there is a tail on the steep progeny curve of calving dates, representing late calves born in August, September and even October, which are the progeny of young stags that come late into the rut. Late calves would be better unborn, as the winter takes an extra large toll of them. A population diminishing in such a manner is in serious danger of extinction, as the mortality of the Red Deer in the first year is at best very high.

Doctor Darling brings out some important factors relative to reproduction, the influence of weather on the movements of the Red Deer and their reaction to changes in temperature, etc. He does not attempt to solve the mysterious paradox of the antlers, but records some interesting observations on their exquisite sensitivity at one moment and their apparent absence of feeling the next.

In a chapter on the various senses, the author states that smell is far the most meaningful sense in the lives of Red Deer. Their reliance on the inclination it conveys is absolute. Hearing is the next most highly developed sense in deer, so far as observations disclose. Hearing, however, may be looked upon as the inquisitive sense. Sight of the deer, he believes, is exceedingly acute. Evidence such as we have, says the author, points to the conclusion that they do not have color vision, though, like most animals, they are more afraid of dark objects than the light. Taste, he states, reflects physiological condition. Thus the need for minerals, chiefly calcium and phosphorus, is felt in the appetite and is satisfied through the sense of taste. Little is known of the sense of touch in ungulates, but from the author's observations, it seems that the muzzle is used as an organ for this purpose.

This book contains 215 pages in legible type, charts, maps, a glossary of the gaelic place names, and a very complete bibliography and index.

GEORGE G. GOODWIN.

GENETICS AND THE ORIGIN OF SPECIES

— — — — — by Theodosius Dobzhansky

Columbia University Press, \$3.60

IT is highly fitting that the *Columbia Biological Series* should resume publication with a volume on the origin of species, because several notable books in this series deal with the evolution of particular groups of animals. Further, in the few decades this series has been in existence our knowledge of the mechanisms of evolution have been nearly completely revised. Evolution today is considered as a change in the genetic composition of populations, and populations

follow laws derived from mathematical reasoning of the behavior of their fundamental units, the genes and chromosomes. Modern students of evolution work with mathematical formulas and microscopic preparations of the hereditary material. Some of them never bother to even glance at the "evidence of evolution" which Museums industriously gather together for they are satisfied that there are many courses of evolution and they concern themselves with causes.

For example, naturalists have known for a long time that isolation of small samples of a species on an island tends to induce rapid evolutionary change and further, the difference between the island and mainland form may not have any adaptive value. But the only adequate explanation for the phenomenon has been given by geneticists who have shown how the hereditary factors combine in isolated communities. Similarly it is such geneticists as Wright, Haldane and Fisher, who have made the most significant contributions in recent years to the general theory of evolution. This mathematical, genetical and cytological data is for the most part published in special journals, frequently unknown to the naturalist who still follows the trials of the founders of the *Columbia Biological Series*. It is, therefore, of the greatest service to students of evolution that Professor Dobzhansky has brought together in a very readable volume, the conclusions reached by geneticists in many laboratories, including those in Russia.

Students of natural history will be especially interested in the chapters on variation in natural populations, selection and isolating mechanisms. A species is found to be not a product of the imagination of a naturalist but an entity with a particular genetic stability. Professor Dobzhansky has made important contributions to our knowledge of the mechanisms keeping species separate in nature, and hence this section of the book which deals with the stock in trade of the naturalist receives careful analysis. It is certain that no more stimulating book dealing with the genetic basis of species has appeared in recent years. It should be on the shelf of every student who is interested in the causes of diversity in the animal and plant worlds.

G. K. N.

I FIND AUSTRALIA

— — — — — by William Hatfield

Oxford University Press, \$3.00

MR. HATFIELD writes of his adventures in Australia as an immigrant boy, seeking such employment here and there as would put him in touch with all the important phases of life in that country as of the pre-World War period. In the opening chapter he takes us at once to the frontier, first to a sheep station where he worked as a herder. From thence he moves on to the cattle country, learns to ride hard, gets dangerously close to arrest for associating with cattle rustlers and then shifts again, this time to horse herding. Then having mastered the art of living in the country, he sets out for

Continued on page 156

SCIENCE IN THE FIELD AND IN THE LABORATORY— *Dating Prehistoric Civilizations—Buffalo Added to North American Hall* —News of Museum Field Activities—Calendar of Events—Lectures

Dating Prehistoric Civilizations

By employing the same stratigraphic methods used so successfully by archaeologists in Egypt, Dr. Wendell C. Bennett hopes to work out the time relations in the lost history of ancient civilizations in the Andes. With this objective the Museum's Assistant Curator of Anthropology left New York, January 11, on his fourth expedition to the highlands of Bolivia and Peru.

It is not expected that actual dates can be assigned to prehistoric ruins and tombs, but that the time-order in the development of those cultures will be revealed. However, once the ruins and tombs can be arranged in a time scale, it will be possible to estimate the dates roughly. On this trip Doctor Bennett will explore several sections of northern Peru to discover how their time relations line up with the sections previously studied. The time sequences of the civilizations under investigation can be discovered by archaeological methods, but to achieve the final result, many hundreds of ruins must be examined and trial excavations made in ancient cemeteries and other places.

The Government of Peru, through its official representatives, has extended many courtesies to the Museum and to Doctor Bennett, thus facilitating his field work in every possible way.

Buffalo in North American Hall

Although buffalo hunting is a thing of the past*, and our Indians have long ago accustomed themselves to other meat, there is at least one favored tribe which even today may feast on their traditional food. These are the Flathead Indians on whose Reservation the National Bison Range of Montana is located. During years of depression, quantities of buffalo meat are given away, and the skins are highly prized by the Indians as robes. In good times, the meat is shipped all over the United States and sold to the highest bidder. The Paleface, too, has apparently developed a taste for buffalo; sometimes carcasses are sold to local meat dealers for \$40 to \$60 each.

These are a few of the discoveries made by Robert H. Rockwell of the Museum Preparation Department who, with Mr. Robert E. McConnell (Chairman of the Committee on the new North American Hall), has been touring the West to obtain specimens for the Hall of North American Mammals. One of the places they visited, and from which they secured their specimens, was the National Bison Range. This Range was established in 1904 by the American Bison Society, and in 1907 Theodore Roosevelt became interested and pushed the plan to preserve

this fast-vanishing phase of our wild life. The Range is now under the control of the United States Biological Survey. Much of this territory, 18,540 acres of northwestern Montana, consists of low rolling hills, intersected by a wide expanse of meadow land. But even this area does not always furnish sufficient grazing to maintain the herds. The drought has been particularly serious, and has necessitated the disposal of fifty to one hundred animals a season. Some of these go "on the hoof" to Zoological Parks, the rest are slaughtered.

The original herd of Bison placed here in 1905 consisted of thirty-four animals. These were from the Conrad Herd, an offshoot of the Pablo-Allard Herd, which was built up from calves captured about 1873 by Walking Coyote, a Pend d' Ocreille Indian. Today there are 350 Bison, 150 Elk, 38 Bighorn Sheep, 170 Mule Deer, and 50 White-tailed Deer. In 1927 the Range had 640 Bison, which is perhaps the maximum number ever attained.

The specimens collected from this herd by the expedition, under permits granted by the United States Biological Survey, which also generously waived the \$300 fee for the animals, include a large Bull, a medium-sized Bull, a large Cow, a young Cow, a two-year-old Spike Horn, and a small eight-months-old Calf.

One other specimen was obtained by Mr. Rockwell. This was an excellent pair of Elk horns which caught his attention immediately on arriving at the Ranch. He admired them so extravagantly that Dr. Robert S. Norton, Manager of the Reservation, insisted that they be brought back to the Museum. They were, and it is expected that they will adorn the crown of the Bull Elk in the North American Hall.

Expeditions in the Field

Reports from far-flung Museum expeditions indicate that many new acquisitions and much new information will soon be brought back to the Museum.

The "Lost World"—Mount Auyan-tepui—has been scaled by the *Phelps Venezuelan Expedition* and a central camp has been established there. Dr. G. H. H. Tate, Mr. William Phelps, Jr., and Mr. Thomas Gilliard of the Museum Staff are now engaged in collecting specimens to facilitate comparisons between the life on top of this isolated tableland mountain and that of the surrounding mainland.

From the New Hebrides, Mr. Macmillan in the field for the *Whitney Expedition* has sent another shipment of bird skins.

Rounding out the news from the Bird Department, Dr. F. M. Chapman, its Curator, has once more established himself on *Barro Colorado Island*, Canal Zone, to continue studies of animal life in his "Tropical Air Castle."

Returning this month from the Philip-

pine Islands and Java, Dr. Willard G. Van Name, Associate Curator in the Department of Living Invertebrates, promises material on the biological distribution of oriental invertebrates in these waters. In one of his reports to his Department he said "the luxuriance and variety of life on the reefs was a revelation to me, far exceeding what I have seen in America in variety of coloration and beauty."

Museum Courses for Spring

In the spring of 1938, the following courses will be offered to teachers in New York City schools, to adult students, and to Members of the Museum. For programs and registration requirements, apply to Room 209, School Service Building, or telephone ENDicott 2-8500, Extension 342.

Courses given in co-operation with the School of Education

The College of the City of New York

1. "Nature Study" (Wednesday afternoons) Miss Farida A. Wiley. First session, February 9, 1938.
2. "The Museum in Elementary Social Studies" (Tuesday afternoons) Mrs. Grace Fisher Ramsey. First session, February 8, 1938.

Courses given in co-operation with Hunter College

Note: The courses listed above will also be given in co-operation with Hunter College.

Hunter College Course given at the Museum

"Astronomy" (General) (Thursday afternoons) Mr. William H. Barton, Jr. First session, February 10, 1938.

Course given in co-operation with New York University

"Astronomy for Teachers" (Tuesday afternoons) Dr. Clyde Fisher. First session, February 8, 1938.

Museum Course in Craft Techniques for Teachers of New York City Public Schools

Miniature Habitat Group Making

Finger Painting

Nature and Geography Crafts

Know Your Museum Series

The spring course in the Know Your Museum Series for members of the Museum will be given by Doctor Roy Waldo Miner, Curator of Living Invertebrates, starting February 15th. The general subject of the course is "The Oceans and Their Significance to Life," and Doctor Miner's individual lectures include such topics as "The Oceanic Shelf," "Coral Reefs of Tropic Seas," "Life of the

* See article *Depression & Revolt* by Dr. Clark Wissner in this issue.

Open Ocean," and "The Inter-relationships of Marine Animals."

The series consists of eight lectures held on alternate Tuesday evenings, concluding May 24th. The meeting place is the Lecture Room, 5th floor, Roosevelt Memorial Building, although much of the time will be spent in the Hall of Ocean Life, where members may have the exhibits interpreted and examine many objects.

Trustees Meeting

At the Annual Meeting of the Board of Trustees of the American Museum of Natural History on January 10th, Dr. William Procter and Robert Woods Bliss were elected members of that Board. Mr. Bliss is a noted diplomat, who has served the United States Government for more than thirty years in many diplomatic posts. Dr. William Procter is president and director of the Biological Survey in Mt. Desert Region, Bar Harbor, Maine. For many years Doctor Procter has made valuable surveys in his own laboratories of the marine and fresh-water animals of

this region. F. Trubee Davison, Lincoln Ellsworth, Clarence L. Hay and Lewis W. Douglas were re-elected Trustees.

The meeting also re-elected the present staff of officers: F. Trubee Davison, president; J. P. Morgan, first vice-president; Cleveland E. Dodge, second vice-president; E. Roland Harriman, treasurer, and Clarence L. Hay, secretary.

In appreciation of their gifts of specimens or financial contributions, the following were elected to membership: Mr. Templeton Crocker, Benefactor; Mr. W. R. Coe, Associate Founder; Mr. William Hale Harkness, Associate Benefactor; Mr. Charles Watson Boise, Cyril F. dos Passos, Mrs. Olga D. Guggenheim, Mr. Simon Guggenheim, Mrs. William Hayward, Mr. Van S. Merle-Smith, and Mrs. Paul Moore, Patrons. Mr. Vincent Astor and Admiral Cary T. Grayson were elected Fellows and Mrs. Elon Huntington Hooker, Mr. James Horn Gilbert, Mr. William G. Brooks, Jr., and Mr. William Sheffield Cowles, Life Members.

New appointments to various depart-

ments were also made by the Board of Trustees. Dr. Charles Russell, President of the State Teachers' College at Westfield, Mass., was appointed Curator of the Museum's Department of Education; Dr. Harold E. Vokes, formerly of the Illinois State Geological Survey, was appointed Assistant Curator in the department of Geology and Invertebrate Paleontology. Dr. Frank A. Beach, formerly of the department of Physiological Psychology, Harvard University, was appointed Assistant Curator in the department of Experimental Biology. Mr. Louis W. Kinzer was appointed Custodian of the American Museum, in the place of J. B. Foulke, retired.

Official status on the Staff was given to Donald R. Barton as Assistant Editor of NATURAL HISTORY Magazine, and Miss Dorothy L. Edwards as Editor of JUNIOR NATURAL HISTORY. The editorial staff of SKY Magazine is officially established as follows: Clyde Fisher, Ph.D., LL.D., Editor; Dorothy A. Bennett, Associate Editor, SKY Magazine; Helene C. Booth, Assistant Editor, SKY Magazine.

YOUR NEW BOOKS

Continued from page 154

himself as a dingo trapper and finally lives with the native blacks for a while. All this time he tries his hand at writing without much success, but after a few of his stories were accepted he turns to town life, making part of his living by odd jobs as an unskilled laborer. At last comes success, as everyone knows who has read his books. Many of the chapters are thrilling adventures, but above all the reader comes to feel Australia, the desert, the bush, the wheat belt and those stately cities so characteristic of that country.

CLARK WISLER.

MAKING PICTURES WITH THE MINIATURE CAMERA

— — — — — by Jacob Deschin
Whittlesey House, McGraw-Hill Book

Co., \$3.00

THE public imagination has been captured by the picture-taking possibilities of the miniature camera, with its fast lens and fraction-of-a-second shutter speeds. Everyone, it seems, wants to take candid camera shots. Stimulated by pictorial magazines, photography exhibits and camera contests, the field of amateur photography is gaining new recruits every day. But actually, this business of taking good pictures is more complicated than appears on the surface. The beginner is confronted with photographic supply stores filled with all kinds of cameras, lenses, filters, exposure meters, tripods, photoflood and photoflash bulbs, reflectors and other accessories. Each veteran cameraman, when consulted, gives a different piece of advice as to what equipment it is best to buy. And once equipped, the budding photographer has a great deal to learn about how to use his gadgets to the best advantage. Experience is a good teacher—but one must be guided at

the start by some fundamental explanation of the ground-work.

Jacob Deschin's book gives just such guidance. Starting at the very beginning, it advises the novice in selection of equipment, and explains the uses of the various camera accessories. The section of the book devoted to "Taking the Picture" treats every type of subject matter: portrait, action picture, nature photography, industrial scenes, interiors, night scenes, and even candid shots taken during public theatrical performances. Equipment, selection of composition, lighting, and angle of shot are discussed, and many minor errors are anticipated and warned against. Succeeding sections of the book give detailed descriptions of equipment and procedure in developing negatives and making prints. The text is illustrated with helpful diagrams and sketches, and is followed by a glossary of photographic terms. The final section of the book is "A Miniature Camera Gallery" of enlargements of all kinds of candid shots, illustrating the possibilities for amateur work and giving the camera and data on each shot.

Thus, the book covers briefly the whole field of picture-making, for those who wish to join the ranks of candid cameramen but who do not quite know how to begin. The writer can say, as a beginner in the field, that this treatment is helpful in its specific detail and in its suggestions for overcoming obstacles and finding new picture possibilities.

J. B. B.

ADVENTURES OF A BIRD WATCHER

— — — — — by Bert Dayton

Palisade Press, \$1.50

THIS slender volume of rather colorless essays in prose, and occasional verse, recounts some of the author's observations afield in southern New York. The notes concern not only birds but other

animals and nature in general. There is little to justify the word "adventures," used in the title, and the recorded observations add nothing to the facts already known about the various creatures discussed. Nevertheless, the author's love of nature is apparent on every page and he has done his best to express this affection and tell something of what he has seen on many rambles through the countryside and from his doorway or window. Occasional digressions into topics beyond the author's own experience are not always in accord with known facts. A few sketches in black and white or with exaggerated color do not improve the appearance of the book which should have received some editorial revision and more careful proof-reading.

J. T. Z.

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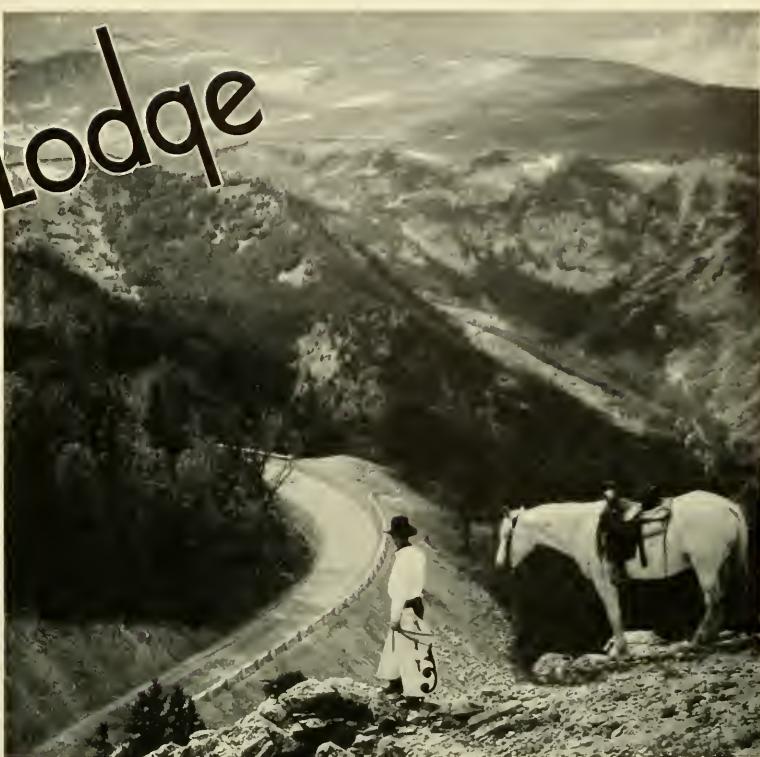
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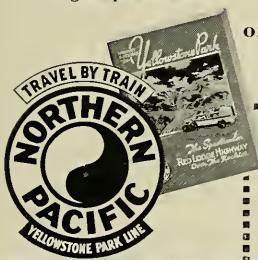
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New Exhibits

PERUVIAN MUMMY—Special exhibit of the contents of a Peruvian mummy bundle, found in Paracas, Peru, and estimated to be about fifteen hundred years old. Loaned by the Peruvian Government through the Peruvian Ambassador at Washington. Education Hall, until February 23rd.

MICROSCOPES—The annual exhibit of the New York Microscopical Society, showing microscopes, binoculars, slides, and other types of precision instruments. One night only, Saturday, February 26th, Education Hall.

February 1

11:00 a.m.—Lecture—*Color Facts*—Miss Cornell—Classroom K—Metropolitan Museum of Art. Open to Public.

12 m.—Tour of Collections: *The Print Galleries*—Meeting Place: Main Hall—Metropolitan Museum of Art. Open to Public.

2:30 p.m.—Motion Picture—*The Etcher's Art; Drypoint*—a Demonstration. Lecture Hall—Metropolitan Museum of Art. Open to Public.

3:00 p.m.—Lecture—*Elements of Design*—Miss Cornell—Classroom K—Metropolitan Museum of Art. Open to Public.

4:00 p.m.—Lecture—*Back of the Great Wall*—Miss Duncan—Meeting Place: Main Hall—Metropolitan Museum of Art. Open to the Public.

February 2

11:00 a.m.—Lecture—*Materials of the Craftsman: Faience*—Miss Bradish—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

2:00 p.m.—Tour of Collections: *European Decorative Arts*—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

3:45 p.m.—Radio Broadcast—*Music of the Spheres*. For the Hayden Planetarium by Marian Lockwood. Station WQXR.

4:00 p.m.—Lecture—*The Gothic Age in Italy and Germany; Barbarian Goths in the Roman Empire*—C. Grant LaFarge—Lecture Hall—Metropolitan Museum of Art. Open to the Public.

February 3

11:00 a.m.—Lecture—*The Art of Flanders: Historical Introduction*—Mrs. Fansler—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

11:30 a.m.—Radio Broadcast—*Polar Exploration*—John R. Saunders—American Museum of Natural History—Station WHN.

2:00 p.m.—Tour of Collections: *The American Wing*—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

February 4

3:15 p.m.—Radio Broadcast—*Choosing*

Seed for the Spring Garden—Miss Ellen Eddy Shaw—Brooklyn Botanic Garden—Station WNYC.

February 5

10:30 a.m.—Lecture for Children—*Jacklighting Wild Animals for the Movies*—Howard Cleaves—American Museum of Natural History—Open to children of Annual and Higher Class (\$10) Members of Museum.

11:00 a.m.—Lecture—*Greek Art and Civilization: Crete of the Hundred Cities*—Mr. Shaw—Lecture Hall—Metropolitan Museum of Art—Open to Public.

12:15 p.m.—Radio Broadcast—*This Wonderful World*—Question and answer program by Museum visitors, broadcast from the Hayden Planetarium—American Museum of Natural History—Station WOR.

2:00 p.m.—Motion Picture—*Trail-mates*—American Museum of Natural History—Open to Public.

2:00 p.m.—Lecture—*Origins and Meaning of American Furniture Styles: Gothic Furniture in Europe*—Mr. Busselle—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

2:30 p.m.—Motion Picture—*Digging into the Past; The Daily Life of the Egyptians—Ancient and Modern*—Lecture Hall—Metropolitan Museum of Art—Open to Public.

3:30 p.m.—Lecture—*Diseases and Pests of Ornamentals*—Dr. B. O. Dodge—Lecture Hall, Museum Building—Bronx Park, New York Botanical Garden—Open to Public.

4:00 p.m.—Lecture—*Earliest Egypt*—William C. Hayes—Lecture Hall—Metropolitan Museum of Art—Open to Public.

February 6

2:00 p.m.—Tour of Collections: *The Arts of China*—Miss Duncan—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

2:30 p.m.—Motion Picture—*Firearms of Our Forefathers; Eve of the Revolution*—Lecture Hall—Metropolitan Museum of Art—Open to Public.

2:30 p.m.—Lecture—*Origins and Meaning of American Furniture Styles: Gothic Furniture in Europe*—

Mr. Busselle—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

3:00 p.m.—Lecture—*Elements of Color: Color Facts*—Miss Cornell—Classroom K—Metropolitan Museum of Art. Open to Public.

3:15 p.m.—Tour of Collections: *The Arts of Japan*—Miss Duncan—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

4:00 p.m.—Lecture—*A Century of American Landscape Painting*—Lloyd Goodrich, Whitney Museum of American Art—Lecture Hall—Metropolitan Museum of Art—Open to Public.

February 7

12:15 p.m.—Radio Broadcast—*Today's Natural History*—Robert R. Coles—American Museum of Natural History—Station WNYC.

February 8

11:00 a.m.—Lecture—*Color in Far Eastern Art*—Miss Cornell—Classroom K—Metropolitan Museum of Art—Open to Public.

12 m.—Tour of Collections: *The Egyptian Collection*—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

2:30 p.m.—Motion Picture—*The Temples and Tombs of Ancient Egypt; The Making of a Bronze Statue*—Lecture Hall—Metropolitan Museum of Art—Open to Public.

3:00 p.m.—Lecture—*Design in English Furniture*—Miss Cornell—Classroom K—Metropolitan Museum of Art—Open to Public.

4:00 p.m.—Lecture—*Buried Treasures of the Han Dynasty*—Miss Duncan—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

8:15 p.m.—Lecture—*The Evolution of the Brain from Fish to Man*—Dr. William K. Gregory—American Museum of Natural History—Open to Annual and Higher Class (\$10) Members of the Museum.

February 9

11:00 a.m.—Lecture—*Materials of the Craftsman: Stoneware*—Miss Bradish—Meeting Place: Main Hall—

Metropolitan Museum of Art—Open to Public.

2:00 p.m.—Tour of Collections: *The Collection of Greek Art*—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

3:45 p.m.—Radio Broadcast—*Music of the Spheres*—Marian Lockwood—Hayden Planetarium—Station WQXR.

4:00 p.m.—Lecture—*Gothic Age in Italy and Germany: Germanic Development of Italian Romanesque Forms*—C. Grant LaFarge—Lecture Hall—Metropolitan Museum of Art—Open to Public.

February 10

11:00 a.m.—Lecture—*The Art of Flanders: The Van Eycks, Their Contemporaries and Their Followers*—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

11:30 a.m.—Radio Broadcast—*Little Known African Mammals*—John R. Saunders—American Museum of Natural History—Station WHN.

2:00 p.m.—Tour of Collections: *Oriental Art: the Near East*—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

8:15 p.m.—Lecture—*The Mystery of Shiva Temple*—Dr. Harold E. Anthony—American Museum of Natural History—Open to Annual and Higher Class (\$10) Members.

February 11

2:15 p.m.—Radio Broadcast—*An Introduction to Clematis*—Mr. Montague Free—Brooklyn Botanic Garden—Station WOR.

February 12

12:15 p.m.—Radio Broadcast—*This Wonderful World*—Question and answer program by Museum visitors, broadcast from Hayden Planetarium—Station WOR.

2:00 p.m.—Motion Picture—*Abraham Lincoln*—American Museum of Natural History—Open to Public.

2:00 p.m.—Lecture—*Origins and Meaning of American Furniture Styles: American Furniture of the XVII Century*—Mr. Busselle—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

2:30 p.m.—Motion Picture—*The Pottery Maker; The American Wing*—Lecture Hall—Metropolitan Museum of Art—Open to Public.

3:30 p.m.—Lecture—*Landscape*—Mr. A. C. Pfander—Museum Building: Lecture Hall—N. Y. Botanical Garden, Bronx Park—Open to Public.

4:00 p.m.—Lecture—*Certain Paintings by El Greco in American Collections*—Edith R. Abbot—Lecture Hall—Metropolitan Museum of Art—Open to Public.

February 13

2:00 p.m.—Tour of Collections: *The Arts of Persia*—Miss Duncan—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

2:30 p.m.—Motion Picture—*A Visit to the Armor Galleries; Drypoint*—a

Demonstration—Lecture Hall—Metropolitan Museum of Art—Open to Public.

2:30 p.m.—*Gallery Talk—Origins and Meaning of American Furniture Styles: American Furniture of the XVII Century*—Mr. Busselle—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

3:00 p.m.—*4-Lecture—Wallpaper: Its History*—Nancy V. McClelland—Classroom K—Metropolitan Museum of Art—Open to Public.

3:15 p.m.—Tour of Collections: *The Arts of India*—Miss Duncan—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

4:00 p.m.—Lecture—*Classical and Oriental Inheritance in Byzantine Sculpture*—Sirarpie Der Nersessian, Wellesley College—Lecture Hall—Metropolitan Museum of Art—Open to Public.

Place Main Hall—Metropolitan Museum of Art—Open to Public.

8:15 p.m.—Lecture—*Origins and Evolution of the Oceans*—Dr. Roy Waldy Miner—American Museum of Natural History—Open to Annual and Higher Class (\$10) Members of the Museum.

February 16

11:00 a.m.—Lecture—*Materials of the Craftsman: Porcelain*—Miss Bradish—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

2:00 p.m.—Tour of Collections: *The Medieval Collection*—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

3:45 p.m.—Radio Broadcast—*Music of the Spheres*—Marian Lockwood for the Hayden Planetarium—Station WQXR.

4:00 p.m.—Lecture—*Gothic Age in Italy and Germany: Effects of Maritime Power in Venice and Pisa*—C. Grant LaFarge—Lecture Hall—Metropolitan Museum of Art—Open to Public.

February 17

11:00 a.m.—Lecture—*The Art of Flanders: The Schools of Bruges and Brussels*—Mrs. Fansler—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

11:30 p.m.—Radio Broadcast—*The Dove*—John R. Saunders—American Museum of Natural History—Station WHN.

2:00 p.m.—Tour of Collections: *The American Wing*—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

February 18

3:15 p.m.—Radio Broadcast—*Interesting Plants in the Brooklyn Botanic Garden Conservatories*—Brooklyn Botanic Garden—Station WNYC.

February 19

10:30 a.m.—Lecture for Children—*Snow White and the Seven Dwarfs*—Rufus Rose Marionettes—American Museum of Natural History—Open to children of Annual and Higher Class (\$10) members of the Museum.

11:00 a.m.—Lecture—*Greek Art and Civilization: The Mycenaean Period*—Mr. Shaw—Lecture Hall—Metropolitan Museum of Art—Open to Public.

12:15 p.m.—Radio Broadcast—*This Wonderful World*—Question and answer program by Museum visitors broadcast from the Hayden Planetarium—Station WOR.

2:00 p.m.—Motion Picture—*George Washington*—American Museum of Natural History—Open to Public.

2:00 p.m.—Lecture—*Origins and Meaning of American Furniture Styles: Baroque Furniture in Europe*—Mr. Busselle—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

2:30 p.m.—Motion Picture—*Tapestries and How They Are Made: The Making of a Stained-Glass Window*

—Lecture Hall—Metropolitan Museum of Art—Open to Public.
3:30 p.m.—Lecture—*The Romance of Plant Names*—Dr. H. A. Gleason—Lecture Hall of Museum Building—New York Botanical Garden—Open to Public.
4:00 p.m.—Lecture—*Social Aspects of Art: Greece*—Karl L. H. Lehmann—Hartleben, New York University—Lecture Hall—Metropolitan Museum of Art—Open to Public.

February 20

2:00 p.m.—Lecture—*Egypt's Classic Age*—Mr. Taggart—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.
2:30 p.m.—Motion Picture—*Digging into the Past: The Daily Life of the Egyptians—Ancient and Modern*—Lecture Hall—Metropolitan Museum of Art—Open to Public.
2:30 p.m.—Lecture—*Origins and Meaning of American Furniture Styles: Baroque Furniture in Europe*—Mr. Busselle—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.
3:00 p.m.—Lecture—*Color Study: Peasant Art*—Miss Cornell—Classroom K—Metropolitan Museum of Art—Open to Public.
3:15 p.m.—Tour of Collections: *Egypt: The Golden Age of the Empire*—Mr. Taggart—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.
4:00 p.m.—Lecture—*Pictures Are Like People*—H. S. Ede—Lecture Hall—Metropolitan Museum of Art—Open to Public.

February 21

4:30 p.m.—Radio Broadcast—*Today's Natural History*—Robert R. Coles—American Museum of Natural History—Station WNYC.

February 22

11:00 a.m.—Tour of Collections: *American Painting After 1875*—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.
2:30 p.m.—Motion Picture—*Firearms of Our Forefathers: Yorktown*—Lecture Hall—Metropolitan Museum of Art—Open to Public.

February 23

11:00 a.m.—Lecture—*Materials of the Craftsman: Jasper Ware*—Miss Bradish—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.
2:00 p.m.—Tour of Collections: *The Egyptian Collection*—Meeting Place: Main Hall—Open to Public.
3:45 p.m.—Radio Broadcast—*Music of the Spheres*—Marian Lockwood for the Hayden Planetarium—Station WQXR.
4:00 p.m.—Lecture—*The Gothic Age in Italy and Germany: Italian Individualism—Rivalry of the Towns*—C. Grant LaFarge—Lecture Hall—Metropolitan Museum of Art—Open to Public.

February 24

11 a.m.—Lecture—*The Art of Flanders: The School of Antwerp*—Mrs. Fansler—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

11:30 p.m.—Radio Broadcast—*The Wolf*—John R. Saunders—American Museum of Natural History—Station WHN.

2:00 p.m.—Tour of Collections: *The Collection of Roman Art*—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.
8:15 p.m.—Lecture—*Woods, Waters and Wild Life*—William L. Finley—American Museum of Natural History—Open to Annual and Higher Class (\$10) members of the Museum.

February 26

11:00 a.m.—Lecture—*Greek Art and Civilization: The Dawn of the Historic Era*—Mr. Shaw—Lecture Hall—Metropolitan Museum of Art—Open to Public.

12:15 p.m.—Radio Broadcast—*This Wonderful World*—Question and answer program by Museum visitors, broadcast from the Hayden Planetarium—Station WOR.

2:00 p.m.—Motion Picture—*Vincent van Gogh*—American Museum of Natural History—Open to Public.

2:00 p.m.—Lecture—*Origins and Meaning of American Furniture Styles: American Furniture (1700-1750)*—Mr. Busselle—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

2:30 p.m.—Motion Picture—*A Visit to the Armor Galleries: The Making of a Bronze Statue*—Lecture Hall—Metropolitan Museum of Art—Open to Public.

3:30 p.m.—Lecture—*Our National*

Parks—Dr. Harod N. Moldenke—Lecture Hall of Museum Building—New York Botanical Garden—Bronx Park—Open to Public.

4:00 p.m.—Lecture—*Social Aspects of Art: The Middle Ages*—Meyer Schapiro—Columbia University—Lecture Hall—Metropolitan Museum of Art—Open to Public.

February 27

2:00 p.m.—Lecture—*Egypt: Decline and End of the Empire*—Mr. Taggart—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

2:30 p.m.—Motion Picture—*The Making of Wrought Iron: The American Wing*—Lecture Hall—Metropolitan Museum of Art—Open to Public.

2:30 p.m.—Lecture—*Origins and Meaning of American Furniture Styles: American Furniture (1700-1750)*—Mr. Busselle—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

3:00 p.m.—Lecture—*Wallpaper: Modern Uses*—Nancy V. McClelland—Classroom K—Metropolitan Museum of Art—Open to Public.

3:15 p.m.—Tour of Collections: *Egyptian Decorative Arts*—Mr. Taggart—Meeting Place: Main Hall—Metropolitan Museum of Art—Open to Public.

4:00 p.m.—Lecture—*The Art of the Engraved Jade in China*—Alfred Salmony, Mills College—Lecture Hall—Metropolitan Museum of Art—Open to Public.

February 28

4:30 p.m.—Radio Broadcast—*Today's Natural History*—Robert R. Coles—American Museum of Natural History—Station WNYC.

THE INDOOR EXPLORER

Continued from page 151

wisdom, prudence, charity, and other estimable qualities had become legendary not only in his own tribe, but among the white men as well. It was from this society, as you have probably already guessed, that the Tammany Hall of our own day developed. "Tammany societies" arose in all of the thirteen original states and were called Tribes. Their meeting places were Wigwams, and the leading officer was called the Sachem. Instead of taking the name of each local chapter from the state in which it was formed, the Tribes adopted such thoroughly Indian differentials as the Eagle Tribe, Otter Tribe, and Tiger Tribe. It is probable that the tribe last named was originally the Wildeat, but at any rate, it is from this particular group that the present day symbol of the Tammany Tiger has been passed down to us. The activities of the Tammany societies were tinged with politics from the very beginning, a distinctive color that deepened as time went on until all but the New York Tribe disappeared and the institution of Tammany Hall became an ineffable landmark in the history of American politics.

Contemporary newspapers have never tired of jibing good-humoredly at the totemistic character of this notorious political organization. The cartoonists who have sketched the totem-animal in all manner of postures are legion and a list of editorial writers who have jestingly referred to the Keeper of the Wampum and other Indianized characteristics of the personnel and ritual would fill volumes. Tammany is indeed perhaps the mightiest single heritage from our Indian culture, but in view of the results of certain recent elections, it might seem that this archetype of "modern totemism" is crumbling. Possibly this fact may symbolize the decline and gradual passing away of totemism in a changing America. For it is probable that, as the years separate us more and more from the halcyon days of the red man, the totem-animals that played so great a part in the culture of our forefathers will rapidly cease to have significance for succeeding generations. The animals themselves may last indefinitely as hollow symbols, but your Explorer suspects that rising organizations will seek their names and their symbols in the emergent culture of a New Age.

—D. R. BARTON.



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NATURAL HISTORY

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Our Rat-Like Ancestor • Dinosaur Quest • Squaw-Man

• World's Fastest Hunt & Robert Cushman Murphy

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEY DAVISON, President

ROY CHAPMAN ANDREWS, Sc.D., Director

VOLUME XLI—NO. 3

★ ★ ★ ★ ★

MARCH, 1938

Ptilocercus, one of the "living dead".....Cover Design

From a drawing by G. Frederick Mason

"Welcome to Good Fortune!".....Frontispiece 164

Dark Skies.....Robert Cushman Murphy 165

A voyage along the least-known continental seacoast in the world

The Fastest Hunt in the World.....C. Suydam Cutting 179

Hunting with a cheetah is an old and favorite sport of the princes of India

The Enigma of the Squaw-Man.....Clark Wissler 185

Another tale of the reservation frontier

The Mystery Dinosaur.....Barnum Brown 190

An expedition brings back footprints of a giant prehistoric reptile

The Living Dead.....Erich M. Schlaikjer 203

Little rat-like patriarchs creep before us as living images of our forefathers

Maple Sugar Time..... 212

The Story of Spices.....Virginia S. Eifert 214

Their colorful rôle in history

The Indoor Explorer.....D. R. Barton 224

Your New Books..... 228

Science in the Field and in the Laboratory..... 234

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DARK SKIES—*A scientific voyage in a 38-foot boat along the rainy Pacific shores of Colombia, the least-known continental seacoast in the world*

By ROBERT CUSHMAN MURPHY

THREE men set forth from Balboa in a small cabin launch in mid-afternoon of September 8, 1937. They followed the dredged channel out from the Canal and headed toward the Pearl Islands, but tins of gasoline piled high in the cockpit and the cramped quarters throughout the craft indicated a voyage longer than the usual "Zone" fishing holiday.

Very flat ground swells undulated toward the launch as she came out from the shelter of the fortified islands. Their lifts far ahead loomed up like breakwaters when they rose above a horizon where cottony clouds seemed to rest upon the sea. Scattered Mother Carey's chickens danced on the surface; rising shoals of *sardinas* made it shimmer and ruffle in patches, and spotted porpoises rolled out lazily. From time to time the flanks of the launch would chatter and hiss as she cleaved through a drift-line of flotsam from the streams. (Her occupants were to see more and worse of that before their voyage ended).

After two hours the tops of some of the Pearl Islands began to show as blurred, tree-covered tufts,

(Left) **¡BIENVENDIA A BUENAVENTURA!**
"Welcome to Good Fortune!" said the Pillar of Cloud that guided the weary mariners into Colombia's Pacific port of Buenaventura, after six days of battering. The entrance to the estuary lies directly under the thunderhead

LIFE on the ocean wave, in pursuance of American Museum objectives, is nothing new for ROBERT CUSHMAN MURPHY, but this article describes his first (and positively last!) thousand-mile voyage in a 38-foot launch. He once covered 17,000 miles—11 months and 14 days without sleeping ashore—in the brig *Daisy*, now the subject of a Benson mural in the Hall of Ocean Life.

Doctor Murphy belongs to that dwindling coterie whose members have crossed the North Atlantic entirely under sail. Both coasts of South America, the subantarctic ocean, Gulf of Mexico, Florida Current and Mediterranean Sea are regions in which he has conducted marine zoological studies in relation to the oceanographic background. He has pioneered in re-

searches correlating the distribution of seabirds with natural regions of the ocean. In 1936 the Museum issued his "Oceanic Birds of South America," a two-volume monograph which has recently been awarded the Brewster Medal. Incidentally, the whole edition of this work sold out more rapidly than any other major publication in the history of the Museum.—EDITOR.

weather is execrable, ports are few and far between, and the charts far from reassuring. The craft of this adventure was a 38-foot twin-motored plaything, with no proper belly for the open ocean. The first source of gasoline, or of any other civilized resources, was at Buenaventura, 400 miles away by the curves of the coast toward which the launch now seemed to be bound. What was the reason for such a journey? Smuggling, the reader might guess, an idea that occurred to several observers during the next three weeks. In fact, when the same launch anchored off the Ecuadorian town of Manta on September 23d, she was unceremoniously boarded by a suspicious captain of the port and a whole squad of *resguardos* ready to do their duty.

But such inferences were quite unjust. The complement on board comprised an American Museum man—which is quite sufficient to account for any seeming madness—a Canal Zone skipper who said that he was willing to take his chances with whatever came up, and proved it; and a Caribbean negro who served as cook and sailor. The last-named neither felt forebodings nor, so far as could be told, suffered any subsequent fear of an imminent end such as gripped his shipmates on many a dark day and impenetrable night. He trusted God or the navigator, perhaps both, and his faith was vindicated.

Needless to say, everything about this little expedition was not as planned in advance. It had been intended, indeed, that a 90-foot Diesel cruiser, with a crew of eleven, should carry the naturalist in security and comfort into new maritime pastures, but *White Shadow* had broken down 800 miles to southward and had been towed ignominiously back to her home port of Guayaquil. Even so, the museum man couldn't very well spend half his appropriation, go junketing to Panama on a well-advertised "luxury liner," and then come home emptyhanded and tell Roy Andrews that the bottom had fallen out! *Will-pet* was provided, a sad little substitute for *White Shadow*, but at least she floated; she had an engine—two, in fact—and she would keep out the rain. "We'll go," said the skipper and I, "and we'll probably come back." We did!

Why Colombia?

One might assume that the west coast of South America is all familiar ground. Panama, Ecuador, Peru, Chile—these four names, at least, bring up a substantial geographic picture. All the world knows the Canal, and steamers carry travelers by the thousands to ports of the three other Hispanic-American republics. But what of Pacific Colombia? Here the imagination meets a blank wall, for no tourists and very few geographers can speak first-hand about the

wild tropical seacoast that extends around a bight of the ocean for more than 600 miles between San Miguel Bay, in the Gulf of Panama, and Cape San Francisco, the northernmost of the bends in the coast of Ecuador.

This region is by all odds the least-known continental seacoast on the globe. Buenaventura is potentially, even actually, an important seaport but it is reached from Panama on a course which keeps the voyager hull-down over the horizon. Tumaco, second among Colombia's Pacific communities, is touched only rarely by a vessel bearing passengers from other parts of the world; it is known also to air-minded travelers as a station where seaplanes come out of the clouds to float briefly in its lake-like haven. But beyond this, Pacific Colombia has lain mostly outside the circle of the world's eyes from the days of the first discoverers. It is safe to say that nine steamers out of ten, bound between the Panama Canal and their first or last port in western South America, follow a track which takes them 150 miles to westward of the greater part of the Chocó.

Historic

When describing a seacoast, one does not ordinarily hark back to the early 16th century. In this case there is a reason, however, for the *conquistadores* are among the relatively few groups of men who have traversed it. In 1515, only two years after Balboa had discovered the Pacific, Gaspar de Morales and Francisco Pizarro visited the highly indefinite district of "Birú," south of the Gulf of San Miguel. Seven years later, Andagoya pressed onward by ship as far as Piñas and Octavia Bays, or possibly farther. In 1524, Pizarro and his companions began the long series of explorations that overcame incredible obstacles of climate and enemies and culminated, within a decade, in the conquest of the Inca Empire. Thereafter the Colombian coast lay on the treasure track between the "Tierra Firme" of Panama and the ports of Peru, but the harrowing heat, never-ending rains, onshore current and troublesome winds soon taught the Spaniards to take the modern shortcut across the bight as far as Ecuador. For of all the unexploited products of the Chocó, the first and most memorable is "weather."

Within slightly more than a century, the British buccaneers had followed their favorite prey to this coast and were harrying Spanish vessels out of Panama, and sacking settlements with consummate cheerfulness. The lonely bays and the roadsteads of uninhabited islands proved superb hideouts. Such places as Gorgona Island furnished abundance of wood, water and food, as related by Captains Ring-

rose and Dampier. Another use for such retreats was concerned with distribution of spoils; apparently no self-respecting crew of freebooters could divide their loot without first arraying it on some broad beach within full sight of all the rascals. Much of their desperate and fearless sniping about was accomplished not in their ships but in long narrow dugout canoes, filched from the inhabitants of the estuaries, the same sort of boat that is used to this day. The buccaneers spread on paper the foundations of the modern charts of this coast. Having very casual ideas about spelling in their own language, they also set down extremely odd renderings of Spanish place names, some of which have been progressively misspelt by map-makers ever since.

Nearly two more centuries passed before the world again took cognizance of Pacific Colombia and Darien. Shortly before 1850 the coast was surveyed by British men-of-war. This was at a time of revived interest in an inter-oceanic ship canal from the River Atrato to one of the streams flowing into the Pacific, a hope that had received advertisement through the writings of Alexander von Humboldt. A number of Americans, among whom Trautwine was first in the field, took part in investigations by land and sea, under private auspices or those of the United States Government, between 1852 and 1873, by which date plans for a canal by such a route were abandoned.

Once again the region sank into an oblivion even deeper than that of the days in which it had been inhabited by an abundance of native Indians. The latter have gradually been replaced by negroes who have infiltrated from old Spanish centers into the forests. Large areas once overrun by *conquistadores* and missionaries have ever since been practically untraveled by white men. The "new population of hardy and enterprising foreigners," predicted as not far distant by Trautwine, has never materialized. The Chocó remains one of earth's foremost wildernesses.

Weather

Rainfall gives the answers. The backbone of mountains and the planetary wind systems combine to make sharply differing zones of climate along the western shores of all America. In the southerly half of the New World where the cordilleras are higher and the expanse of ocean greater, the effects are more contrasting than on the Pacific coast of North America. Thus if we stand at Panama and turn the eye of fancy southward, we find a succession of climatic areas laid out with almost diagrammatic precision between the Andes and the sea. If

we think in terms of northern-hemisphere seasons, a generalized summary of the conditions is as follows:

Panama: Summer rain, winter drought.

Pacific Colombia: Rain all the year.

Western Ecuador: Winter rain, summer drought.

Coastal Peru and northern Chile: Drought all the year.

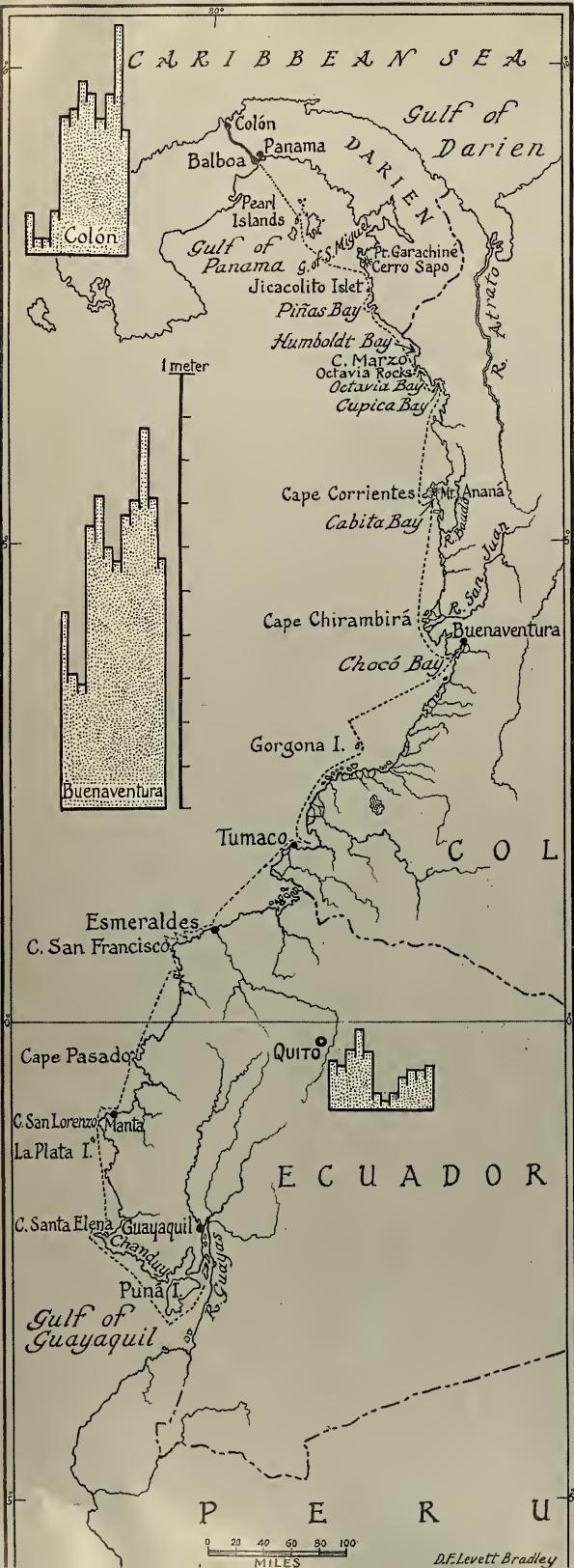
Southern Chile: Rain all the year.

At the Isthmus itself the dry period of the northern-hemisphere trade wind season continues from December to April, more or less. This is followed by a rainy season between May and December, which coincides with the return of the sun to the northern hemisphere, the retraction of the trade wind belt toward the northerly edge of the Caribbean, and an invasion of the southern-hemisphere trade winds across the equator.

Jumping now to Ecuador, we find the cycle similar to that of Panama but with the seasons reversed. The dry period comes during the rainy months of Panama and is coincident with steady southerly winds, which are really the deflected southeast trade winds of the Pacific coast of South America. They blow from cooler latitudes toward the equator and consequently receive no chilling to cause condensation of their moisture. The Ecuadorian wet season holds sway during the northern-hemisphere winter, when all is dry at Panama, and it begins with the retreat of south-wind influence down the Peruvian coast and the incidence of northerly winds from the direction of the hot sea off Colombia.

In between these two climatic regions, or along the coasts of Colombia and northernmost Ecuador, rainfall is practically perpetual because the area may be said to share the Isthmian wet season during one half of the year and the Ecuadorian wet season during the other. There is no dry period whatsoever, and very little consistent monthly variation. In fact, the Colombian Chocó is one of the world's centers of maximum precipitation, where the annual deluge is recorded in feet or meters rather than in the conventional inches. The land is buried under supremely luxuriant rain forest, and one finds nothing corresponding to the savanna lands of Panama. Ground and vegetation reek and steam, but never parch. If the jungles of the Isthmus have become symbolic of all that is dense and impenetrable, it is chiefly because so little is known about those of Pacific Colombia, where the native inhabitants say, *en Darien se corta en un mes, lo que se tarda un año en el Chocó*. The reference is to progress behind the hacking blade of a machete; it signifies that in Darien one can cut in a month a length of trail which would require a year in the Chocó!

According to the early chronicler, Cieza de Leon,



the Spaniards soon learned that January, February and March, when northerly breezes hold, were the best months for beginning a passage from Panama toward Peru. *Wilpet*, like the craft of Pizarro's first venture, was setting out in September, midway in the prolonged season of south to southwest winds; according to our experience, these proved exasperatingly steady even if not always violent. From the ninth to the twenty-sixth of the month, indeed, we met with only a few hours of northerly airs, which came as catspaws between sunrise and eight o'clock of a single morning. At all other times the monotonous southerly régime was interrupted only by occasional calms.

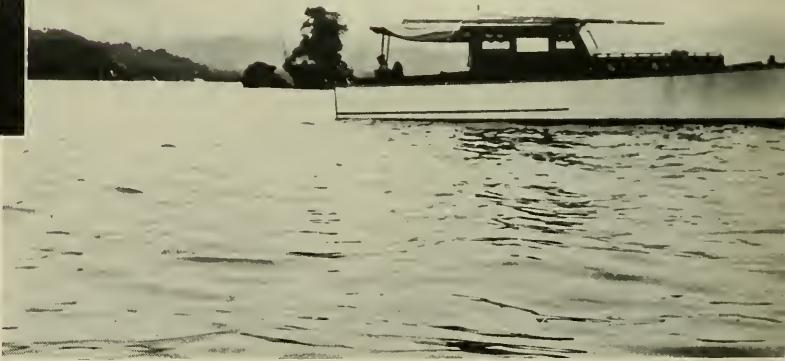
It was still pitch dark when we departed from our first anchorage, without so much as a peep at Pedro Gonzales and its neighboring islands. On most maps such an archipelago as this appears so concentrated that it would seem almost impossible for a boat to worm through it without running high and dry. In reality, *Wilpet* chugged on a straight course down the South Passage, with room to spare for a whole navy. Once beyond land's end of Las Perlas, our trials began. Choppy cross seas, superimposed upon a long ocean swell, bounced us about in ghastly fashion. The rain, descending as a smothering, drowning flood, was no doubt a blessing, for it helped in a measure to flatten the race of wind-whipped ridges.

A sizable craft, however badly beaten, acquires a semblance of rhythm toward which the body responds by subconscious adjustments. The same is true of any boat steadied by sails, except when it wallows in a tumbling calm. But the movements of chunky little *Wilpet*, on every bad moment of our voyage, proved largely unpredictable. Danger was less to the launch than to its crew because of the constant liability of hurtling against some sharp projection. Using a camera, or shooting sea birds for specimens, became equally hazardous, as I learned with a vengeance on September 12th. While endeavoring to photograph a headland from the bow, and bracing myself against an expected roll, *Wilpet* suddenly careened at another angle and tossed me neatly to the sharks. By quite automatic presence of mind, I contrived to leave my camera on deck!

The 38-foot cruiser's course along the coast from Balboa to Guayaquil is shown by a dotted track-line. Generalized patterns of rainfall for three regions discussed in the article are illustrated by monthly averages for Colón, Buenaventura, and Quito. Note that October rainfall at Buenaventura (not the wettest part of the Chocó) amounts to .97 of a meter, or more than 38 inches

(Right) FAREWELL TO PANAMA. A look astern from *Wilpet* toward the Pacific entrance of the Canal on the calm, sultry afternoon of September 8th gave no hint of the incessant head winds that were to bedevil the voyagers during the next 18 days

(Below) CAPTAIN LEE B. CARR, of Balboa, lost 26 pounds weight during the voyage. Once, while the author was incapacitated by an injury, the captain stood continuous watch for 28 hours in a bad sea. Ordinarily, skipper and naturalist alternated at the wheel



(Right) The expedition launch at anchor in the quiet lee of Cabita Bay. Although hardly an appropriate argosy for a thousand miles of the open Pacific, *Wilpet* never faltered so long as there was "juice" in her tanks

(Right) "SILENT, UPON A PEAK IN DARIEN," the sun rises, on September 11th, over the mountains behind Punta Jarque, just south of the entrance to Piñas Bay. At this point, the coastal or Baudó range perhaps attains its greatest altitude, which may be about 4000 feet. The nearer and lower foothills are outlined by white early morning mists





(Above) MOUNTAIN OR MIRAGE? Cloud-truncated Mt. Ananá (marked by the arrow), and also the cone of its lesser neighbor at Cape Corrientes, photograph clearly from a position off Puerto Solano, 42 nautical miles to northward, in mid-forenoon of September 12th. The higher peak had been visible to the eye, indeed, at twice that distance, a phenomenon probably to be explained as a result of atmospheric refraction



(Above) HOW HIGH IS ANANÁ? Only 1500 feet, says the hydrographic chart, yet the mountain, or its mirage, had appeared at a distance of 80 sea miles, from north of Cape Marzo! In this photograph, the peak bears due north of an anchorage in a cove of Cabita Bay. It might seem simple to carry a barometer to its summit, but three days' labor could scarcely cut a trail from the water's edge even to its base

(Right) CHOCÓ FAMILIES provide their own power when traveling far and wide, on fresh water and salt, in the graceful *ca-yucos*. For bulkier cargo there are larger craft, likewise hewn from single trees of the rain forest. Long antedating an inter-oceanic canal, are "drags" across which such boats can be hauled from Atrato drainage to that of the San Juan or the Baudó, which means, in effect, from Atlantic to Pacific





(Left) ELLIOT'S PETREL, a species of "Mother Carey's Chi-ken" first described in 1859, as *Oceanites gracilis*, by Dr. Daniel Giraud Elliot, whose bronze bust adorns the American Museum's Hall of Birds of the World. So far as known its portrait has never before been captured by a camera

(Below) OCTAVIA ROCKS, bearing slightly east of south, and, at the left, the reef and chain of islets at the tip of Cape Marzo. The Octavia cluster had no previous fame in the annals of natural history, but when this photograph was made seabirds new to the west coast of South America had just been sighted



(Right) OCTAVIA ROCKS, bearing north-westward, as *Wilhelmina* passed between them and the mainland. Brown Noddies, Bridled Terns, Red-billed Tropic Birds and other oceanic sea fowl were recorded in flight about them, and the first two of these species appeared to be nesting in large numbers on the upper slopes of the rocks

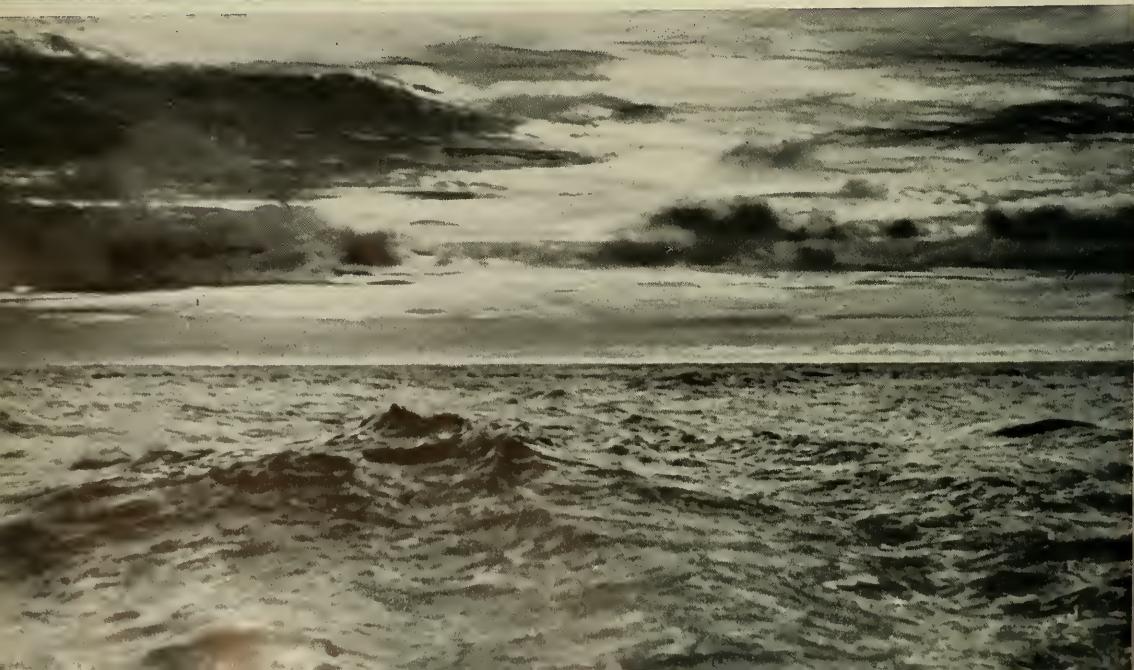
DARK SKIES



(Left) "RAINBOW at night, sailor's delight," goes the old meteorological jingle. This brilliant arc, which at times extended itself into a complete bow, was reflected from heavy mists over Cape Corrientes toward the end of a rough and exhausting day at sea. Its promise of hope was well justified for, within an hour, *Wilpet* found a snug and restful anchorage in a rocky basin under the shadow of Mt. Ananá



(Below) Equatorial sunset. Sky and sea toward the west, off Cape Corrientes, at the hour when southerly winds that had puffed all day gave place to calm, while *Wilpet* raced before the rollers toward a night's shelter in Cabita Bay. Although the rainfall along the Pacific coast of Colombia can hardly be exaggerated, it is equally true that rainy skies are there not "dull" skies. On the contrary, the aspect of both ocean and heavens is nearly always lively, colorful and spectacular





(Above) A BLACK SQUALL bearing down toward the launch on an otherwise quiet morning off Point San Francisco Solano. Six or seven more distant flurries of this type were within sight simultaneously, and in each the rain appeared to have a slant all its own!



(Above) SERRIED CLOUDS, characteristic of rainy Chocó skies, as seen toward sunset in the estuary of the River Dagua, below Buenaventura



(Right) "WILPET" at anchor (over the little point) beside one of the faery islets in Cabita Bay, behind the hook of Cape Corrientes. In the foreground is the mouth of a brook which, a few yards upstream, becomes a series of cascades tumbling from near the base of Mt. Ananá



(Right) FESTOONED SEA CAVES surround the foot of the islet shown above. The supremely luxuriant vegetation of the Chocó coast is still relatively little known but is in large measure very different from that of either Panama or Ecuador. Shrubs, air-plants, lianas and ferns fill interstices among the trees, and drape all exposures.



(Above) POLYNESIA at the edge of the Chocó! At Gorgona Island, which lies well outside the zone strongly affected by river water, coconut palms, which are salt-resisting light-loving friends of man, occupy fragments of a narrow fringe between the dark jungle and the ocean. In some such places, lemons, bananas and other culture plants likewise flourish

(Right) "THIS is the forest primeval." Wherever the steep hillsides of Gorgona Island descend to beaches of rough shingle, the trees of the rain forest, with their vines, orchids, monkeys, sloths and arboreal birds, still stand as it was in the beginning

(Below) THE COAST of Gorgona is an alternation of coral spits, like this charming beach, and stretches of impassable broken rock



(Below) MONTECRISTI, the name of which is associated with the finest of so-called "Panama hats," looms up behind Manta, Ecuador



After dropping the Pearl Islands on September 9th, we could see for a while only the lofty Cerro Sapo—Mountain of the Toad—near Point Garachiné on the main. But when this too had been blotted out by pounding squalls, we held our course for several sightless hours and then turned sharply eastward until, a stone's throw ahead, the mighty, over-powering coast loomed up behind its rain-curtain fringed with foam. The swell was very high, the cloudbursts of maximum intensity, as we skirted southward toward our next haven in Piñas Bay. Above a foundation of dark water-worn rock, up which the suds of the heaving Pacific rode, the slope rose almost like a cliff, but covered as far as the eye could peer into the mists with the hugest and densest of tropical rain forest.

The lower line of the vegetation was level and continuous, just out of reach of the waves. *Chevaux de frise* of long green boughs stretched, indeed, over the swirling water, and their very shadows were invaded by black terns, small petrels and flying fish, a phenomenon I had never seen elsewhere. Here and there creamy torrents gushed over the rocky base, and sometimes we could make out the silvery thread of a cascade far up among the tops of spreading hardwood trees and palms.

A restless anchorage

Just where we were was for a time conjectural, but in late afternoon when we seesawed on the rollers through an opening between a chain of wooded mounds and an opposite promontory, the topography was seen to fit the Jicacolito Pass of our chart. Six miles beyond, the double Sentinel Rocks off Piñas Bay confirmed the position and, as darkness closed, we raced the breath-taking swells to an anchorage in a cove where man had never left a lasting mark but where, no doubt, dauntless Pizarro had moored his clumsy bark on about the same date 413 years before. It was not possible for our feet to tread the shores of the somber Eden because, as the Pilot Book so ironically informed us, the harbors of this savage coast offer excellent protection "against all but southerly winds"!

Five jerky rolls, a pause, five more rolls, a pitch as we yank on the cable, then a repetition of the whole tiresome cycle, are not conducive to peaceful slumber. But at least we gave ourselves twelve hours of it, and this night, no less than the preceding day, proved typical of our voyage. Aside from the punishment of endless motion, about which nothing whatsoever could be done, we also had to make frequent nocturnal choices between sweltering or being well sprinkled. A small porthole would suck a breath

of air across my face until a heavy spatter of rain would lead me to screw it up. The alternation of drenching and of gasping for a lungful of night air, the opening and the shutting—a score of times between dark and dawn—eventually became a response which required no more consciousness than enough to hear the overtones of rainproof cicadas mingling with the snoring of the sea.

Tropical rain

Only those who know the tropics have really seen rain. Here in Pacific Colombia, as we entered one of the most humid sections of all the world's tropics, the power of searching and penetration possessed by the fountains of the clouds was revealed as I had never before imagined it. Drips worked through well-painted layers of new canvas and teak; rain water sometimes fairly sprayed around the edge of plate glass supposedly well sealed in grooves of bronze!

Piñas, Cupica and Cabita Bays were our successive ports on the six-day leg of the journey from Las Perlas to Buenaventura. Always we slapped into adverse winds and waves; always the strong current was against us except when, upon rounding a cape, we might for a time pick up the aid of an eddy and add its speed to the thrust of our engine. Operating only one of our twin motors at a time gave an added sense of safety, as well as fuel economy; only on brief occasions were both motors absolutely required to drive us through the punch of sharp head seas. Rain that blotted out the world beyond the circumference of a few boat lengths left us to the poor solace of dead reckoning for hours on end. Sometimes a period of such diurnal twilight would be succeeded, under a shining sun, by gleaming, blinding, white mist, resembling steam, which dazzled the eyes and completely baffled vision. At such times a perfectly calm silvery ocean surface might still be stirred by such heaves that maintaining balance involved hands as well as feet; the table could not be set for a meal, and Adonijah's viands, wretched at best, would have to be skilfully juggled on their way to the mouth.

Blind travel was disquieting not so much because of the peril of unseen shores, for they could usually be heard. It was flotsam, which moves in silence, that kept us on tenter-hooks, the more so because the great distances between harbors often compelled us to begin the laps of our voyage long before dawn or to face the worse alternative of extending them long after sunset, and of feeling for a strange anchorage in the dark. South of Cape Corrientes, where the bulwarks of the coastal mountains turn inland, many

great rivers bear to the Pacific in their rain-swollen spates the limbs and boles of vast trees. Some of the latter are so heavy or so water-logged that they float awash—so fully submerged, indeed, that the warning boobies and terns fail to use them as rafts. We grazed innumerable bits of forest wreckage of all sizes but, as the great Captain Cook once wrote, “by the grace of God and the skilful maneuvering of the ship,” we received no shivering blow. At Cabita Bay I paced off drift logs that had piled on the rocks. One of them was four feet in diameter at its base and 72 feet long! If *Wilpet*, making seven knots, had happened to strike such a timber end on, the reader would have been spared this tale.

But, above all other specters stood that of fast-dwindling gasoline, a commodity not to be found *en route*. The only human beings we encountered, indeed, between Panama and Buenaventura were four negro youths in a skiff at Cupica Bay; the only man-built structures a few palm-thatched huts at the edge of the forest. We were obliged to forego many a fascinating incidental look-in along our course; we had to hurry, and yet conserve, at all times when not at anchor. An estimate, regarded as liberal at Panama, had led us to believe that we would arrive at Buenaventura with a residue of between 50 and 100 gallons of fuel, but because of the winds and currents we actually entered that port with tanks nearly dry—less than five gallons.

Routine and its purpose

However, the explorations in *Wilpet* were not undertaken for the morbid enjoyment of hardship; there was work to do. Modern marine biology rests upon a comprehensive physical basis. Only by learning a great deal about ocean water can one lay the groundwork for an intimate understanding of the chains of life within, upon or above it.

My first problem was to determine the character of the Colombian coastal water in comparison, for instance, with the very different and better known water of the cool Humboldt Current along the Peruvian coast. The equipment for our investigations comprised surface thermometers, a reversing thermometer for depth readings, hydrometers for approximate determination of the salt content, and water-sample bottles which would permit of subsequent and more precise computation of salinities in the laboratory. Barometers, a transit, a current-measuring log-line, a plankton net of fine silk and other collecting and preserving gear completed the outfit. The unforeseen shift from *White Shadow* to *Wilpet* caused a certain curtailment of the instrumental program, but we still succeeded in gath-

ering various statistical data at a total of 42 stations between the Gulfs of Panama and Guayaquil. The correlation of our records with observations by others, and with specimens of sea life obtained during the voyage, promises to yield useful knowledge, both new and confirmatory.

Some of the fundamental conclusions from our findings may be stated now, as follows:

No air temperature as low as 70° F. was met with either by day or night anywhere to northward of Point Santa Elena, Ecuador. Nevertheless, at any hour of the entire trip the sea surface was all but invariably warmer than the shade temperature of the air. The highest water temperature was 84° F., and the average of all the records made between Panama and Santa Elena was 80.5°; the mean for all air temperatures taken simultaneously with water readings was 77.4°. In this relationship, which is the opposite of that in the Humboldt Current region, we recognize one item in the stage-setting for heavy precipitation. Both the rain water and that of the Colombian streams proved, of course, consistently cooler than the sea.

The layer of warm surface water is relatively thick all along the Colombian littoral because the oceanic current flows toward land, the uppermost water doubtless driving ahead of that below. This, again, is a departure from the régime in Peru, where a divergence of the surface layers produces upwelling of cold water along a broad band paralleling the shore.

From a fixed point at Gorgona Island, southwest of Buenaventura, we could clearly note the steady movement of floating objects northeastward toward the continent, at a rate of half a knot even where there was full shelter from the wind. Elsewhere, a still stronger set sometimes counteracted the labor of *Wilpet*'s engine to the extent of more than one nautical mile per hour.

Salinity

As to salinities, we found an extraordinary zonation due in part to the effect of a current proceeding from regions offshore and southward, where precipitation is less and evaporation greater. Close along the generally steep coast between the Isthmus and Cape Corrientes, the salinity was of the order of about 25 parts of salt per thousand of water (as against, for example, 36‰ which is common in the North Atlantic). It would doubtless have been even lower but for the fact that the enormous rain water run-off on the landward slopes of the coastal mountains finds its way not into the Pacific which washes their very base, but rather into the distant Caribbean by way of the River Atrato. On the other

hand, along the low shores from Cape Corrientes to the Ecuadorian border, where an incredible volume of river water spews out the rainfall of a western watershed, the salinity drops below 20°/oo or even below 15°/oo.

Now sea water of such composition is green rather than blue. But whenever *Wilpet* turned her bow offshore for a few miles, as on our long seaward leg south of Chocó Bay, the color gradually changed to indigo, the river flotsam and the life associated with it was left astern, and the salinity rose concurrently to more familiar pelagic levels. At Gorgona Island we found it to be a little above 31° oo. Furthermore, the marine life of this island proved to be mostly of pelagic type. In particular, the thriving groves of staghorn corals, which require clear and relatively saline water, were a sure indication that the current here maintains a perpetually landward direction. It is very unlikely that even during the season of northerly winds the extraordinarily fresh waters found close to land can ever dominate the zone lying 25 or more miles offshore.

As regards precipitation in September, we found that rain fell during about four-fifths of the elapsed time on our passage from the Pearl Islands to Cape San Francisco, where we abruptly entered the sphere of the Ecuadorian dry season. Hours without rain were rare at night, but much of the diurnal rainfall came in the form of tempests and cloudbursts, with intervening periods of extremely clear and sometimes sunny weather, marked by amazingly good visibility. Moreover, we found even the wettest and darkest skies of the Chocó to be picturesque and lively, with whirling, kaleidoscopic cloud forms, rapid changes in light and shadow and in the varied tinting dependent upon transmitted, reflected or prismatic color. Rainbows were no less common and brilliant than black squalls were frequent and violent. The heavens were never dull or leaden, as rainy skies are so likely to be in other parts of the world.

Sea Birds

I have published a two-volume book to demonstrate that the distribution of oceanic birds is largely determined by the characteristics of ocean water. Therefore discoveries were to be expected in a region that was almost a blank page insofar as concerns its birds. But for the inadequacy of *Wilpet* and the absurdity of the only tender we could carry on deck, we should have found the solution, in all probability, of a number of ancient ornithological mysteries at islets along our track. The evidence was all but conclusive, and on my next trip. . . . But it will not be made in a 38-footer!

Outstanding among our discoveries was the fact that the coastal waters between Darién and the Gulf of Guayaquil constitute the previously unknown winter home of the black tern (*Chlidonias nigra*). Bird books inform us that this North American species migrates from its breeding grounds southward to "Surinam, Peru and Chile." Such a vague statement of winter distribution, however, is based upon only a handful of records, and the evidence seems conclusive that most Peruvian and Chilean specimens were mere stragglers. Black terns that reach the western coast of South America winter en masse off the Chocó or in adjacent waters, resting on flotsam—two to every drifting coconut, a hundred on each floating tree!—and feeding by stooping to the surface over areas in which schools of predacious fishes are engaged in carnage. On every day of our voyage, except when we had turned off into the far blue reaches beyond the range of coast-huggers, I saw tens or hundreds of thousands of these terns in the gray winter plumage, circling like merry-go-rounds above the finny butchers and fluttering to the water for morsels. But never did I see one plunge in the traditional tern manner.

In unknown breeding station

It is an old ornithological tradition that few blue-water tropical sea fowl—birds of South Sea island type—nest anywhere close to the west coast of South America. The peculiar oceanographic conditions and the broad island-free belt separating the continent from Polynesia have been presumed to interpose a barrier. Therefore it was with genuine astonishment that I began to see off Cape Marzo on September 11th numbers of brown noddies (*Anous stolidus*) and bridled terns (*Sterna anaethetus*), which we promptly found swarming all over Octavia Rocks, just off the bay of the same name. But for our worries over fuel supply, and a sea surge far beyond the capabilities of our dinghy, I believe that we might have made even more exciting discoveries at this hitherto unheard-of breeding station. With difficulty we shot and recovered specimens to establish the identification, then reluctantly hastened on our way. Later I learned that these birds feed throughout the indigo offshore belt at least as far southward as Gorgona, and it is not unlikely that they nest also on one of the outliers of that island.

Of the mingling of tropical with cool-water southern sea birds off the Ecuadorian coast; of the Cape pigeon and other antarctic petrels that greeted us at the very equator; of the routes of Sabine's gull, the phalaropes, the jaegers, and fellow migrants from the far north, which seem to avoid the Chocó and to

fly direct from Panama to Cape San Francisco—of these matters and much more I might also report, but they are a story in themselves.

Corrientes

From a distance of 82 nautical miles we had seen during lucent clearings the cone of Ananá, the pineapple mountain of Cape Corrientes. The chart records its altitude as a mere 1500 feet, but to be sighted as we first saw it, the peak would have to rise at least 5200 feet above the sea! Atmospheric refraction, of course, may have been responsible for lifting it into view; doubtless its true height is between the stated extremes.

By four o'clock in the afternoon of September 12th, ten hours along on our daily stint, the thunderous rainstorms had passed by, though the south wind continued to blow as fiercely as ever. Spectacular Cape Corrientes now showed in full majesty, with its greater and lesser domes rearing up behind the sheer steep of the ocean front. This cape, without fame only because yet unknown to the world, is the Hatteras of Colombia, though an imposing mountain instead of a sandy beach. We knew, at any rate, that *Wilpet* was due for a lively hour before rounding it.

Gorgeous rainbows formed over the emerald precipices. Here and there, landslides had sent down great trees, so that the flat umbrellas of their roots shattered the surf. From such wounds some of the wandering logs we had met may have come. A few scars exposed bare red earth, though in the heat and moisture of the Chocó even vertical faces heal over like magic with vines and other vegetation of a paler green than the forest. Man-o'-war birds sailed above the heights and boobies were perching about the caves, arches and fountain-holes of the rocks.

The sun was setting when the launch rounded the southern tip of the cape and surf-boarded the swell into Cabita Bay. Our 85 miles for the day had been slow and exhausting; now we had no time to lose in locating a safe anchorage among the grottoes of this Prospero's coast. In the dim light of the afterglow we sounded and found it, a pool of three and a half fathoms under the shadows of some rocky stacks which bristled as thickly with trees as a sea urchin does with spines. Far overhead, Mount Ananá was rapidly changing cloud veils in the light of the half moon. The spectacle was unbelievable. It was a bit overwhelming to consider, moreover, that in this spacious bay, nine miles wide and with room and depth for an armada, little *Wilpet* was the only craft afloat. Next day, in fact, the single sign we found that man had ever been here since

the beginning of the world was one tiny, flimsy lean-to in the heavy shade beside a stream.

Finale

The heading is wrong, for when I was awakened by a burst of bird song and the screaming of *pericos*, just as the rising sun gilded the sharp summit of Mount Ananá, our voyage was not ending. On the contrary, it had only just begun, and the worst was yet in store! If we could have looked into the future on this rare and glorious day, our hearts might have failed—the skipper's and mine, and even that of stolid old Adonijah Perry, our black man whose King James Bible name proved too much for the Colombian port officials. (From Buenaventura forward, he appeared on the ship's papers as "Alejandro Perez.")

For ahead of us lay the bars and rollers of long mangrove foreshores and the strong currents of Chirambíra; the jagged rocks and the jungles of beautiful and terrible Gorgona, where a fer-de-lance bit my right leg, and a bot-fly larva infected my left so that I limped for three months afterwards. Then followed the fearful struggle, during a howling, pelting day as obscure as night, between Gorgona and Tumaco, when *Wilpet* for the first time nosed under, and took solid water along all her shaking length; when our compass had gone awry from the development of sub-permanent magnetism in the hull, so that the skipper had only the seething outer edge of a coastal reef to point a parallel course toward the port which neither he nor I ever expected to behold. And next there was the Colombian bush negro, who swore he was a *práctico* and that he knew every inch of the coast between Tumaco and Guayaquil. But he was a liar in search of free transportation; he ran us on the mud flats outside Esmeraldes at nightfall, and I ought now to be remembering only that we were promptly capsized and drowned. But after the skipper had grimly worked us off, only to face fourteen more relentless hours of rain and wind and slugging sea, and when we had restrained ourselves from tossing our precious "pilot" overboard by recalling that his name stood on the papers and that he would, unfortunately, have to be accounted for at the next port—then, three formidable saints still stood across our path in the guise of the bold Capes of San Francisco, San Lorenzo and Santa Elena.

And the lady proved the most implacable of the trio! At six o'clock in the morning of September 25th we rounded Santa Elena, and ran for sixty-five miles through the terrific side-roll that came without a buffer from the South Pole, with no hope

Continued on page 231

THE FASTEST HUNT IN THE WORLD—*In one of their oldest and favorite sports the princes of India depend upon the fleetest-footed animal on earth, the cheetah or hunting leopard*



Courtesy Hubert Jay Stowitz and The Illustrated London News

By C. SUYDAM CUTTING

CHEETAH hunting for deer or antelope is a sport that has been common to both Africa and Asia for a long time, and beside it a fox hunt is slow work. We know from paintings that it was popular with the Mogul conquerors of North India many hundreds of years ago, but today in this country the practice has deteriorated until only a few places remain where one can see such a hunt.

One such place is the native State of Kolhapur situated in the Deccan of South India where the Maharaja, an ardent sportsman and great pigsticker, adores this chase. He keeps a marvelous establishment

most scientifically run for the training and care of the cheetahs and for the general organization of the sport. It was the writer's good fortune to attend such a hunt in company with the Maharaja and to observe the actions of seven of these extraordinary animals in successful pursuit of black buck.

It is an amusing sight when one walks into the long, high building in which the Maharaja houses his cheetahs and sees the lot of them sitting on their individual charpoys or native beds along the wall. Each cheetah has his hood on, which is a black band of cloth fitting snugly around the head. Two personal attendants watch over each animal with infinite care, for they are worth \$500 apiece and up.

C. SUYDAM CUTTING has done extensive exploratory work in Central Asia and elsewhere, and has brought valuable material to the American Museum of Natural History, of which he is a Trustee. Of his five expeditions to Central Asia, three were to Tibet, one to Chinese Turkestan, and one to the Chinese-Tibetan border. Correspondence over a period of years with the late Dalai Lama brought Mr.

Cutting the unusual privilege of visiting Lhasa, the "forbidden city" of Tibet (NATURAL HISTORY, February, 1936), which few explorers have reached. He has visited the city twice. He traveled to Abyssinia in 1926-27 for the Field Museum; and in 1927-28 accompanied a punitive expedition of the India Government to the back country of Assam. He visited the Andaman Islands in the Bay of Bengal in 1933 under the auspices of the Pitt-River-Museum of Oxford and the Census of India. An expedition to the Celebes was for the purpose of bringing back the anoa, a dwarf buffalo, for the American Museum. Readers will recall a number of articles by Mr. Cutting which have appeared in NATURAL HISTORY Magazine.

—THE EDITOR.

There are 35 of them lining the walls, the youngest of which is three years old. Cheetahs live wild in both Africa and Asia, but those of the former are larger and attain a greater speed, and are therefore preferable. The Maharaja imports them wild from Kenya, where they are snared and proceeds immediately with their domestication and training. Curiously the cheetahs take kindly to their keepers. They respond far more readily than do leopards, for although the Maharaja has seriously experimented with young leopards, he has got absolutely no results. The Maharaja sells some of the surplus cheetahs he has trained to other princes of India, one of whom is the Gaekwa of Baroda, whose niece he married.

In describing a cheetah it is probably more accurate to classify the animal as a cat. The height at the shoulders is about the same as an adult greyhound with the body and legs much resembling the latter, particularly the legs, which lack the back leg knee bend so prevalent in lion, leopard and tiger. Again the feet are those of a hound, with heavy non-retractile claws, but they are much larger. Yet for all these resemblances to a dog, a glance at one is enough to classify them as cats: their markings are spots; their skull, eyes and teeth are feline; their habits purely carnivorous; and lastly, they have a definite purr.

Training

Like falcons, they wear the hoods at all times except when being fed and exercised and at the moment when they take part in the chase. Their daily exercise varies. Usually they are led up a road on a halter by one keeper (they do not strain at the leash) and are then encouraged to run back to another keeper who holds a piece of meat in his hand—all of which they do with little enthusiasm. The other form of exercise is a real black buck hunt, which must be held at periodic times to keep them up to the mark for the days when the Maharaja is out.

Tame as the creatures may be, the keepers made us understand that it was not advisable for strange whites to fondle them even when on their *charpoys* with hoods on.

In Kolhapur the quarry is always black buck and the cheetahs were strictly trained to kill none but adult males. Because these are readily distinguished in any herd by their much darker color, a slow and curious process of familiarizing new cheetahs with this shade is carried out, in which the men who feed them are exclusively dressed in dark robes, while their regular keepers are not. Following a kill the animal is always allowed to feed, but should it have killed a female, it is haltered and pulled right away—a punishment that soon teaches its lesson.

The cheetah's speed is simply amazing. He is well aware of it and knows that no other animal can come near to standing up to him. The lion, tiger and leopard rarely rush their quarries more than 100 yards, after which they cease, knowing that they cannot run down game that has once attained its maximum speed. Trained cheetahs, however, proceed slowly and methodically, choosing their quarry out of the herd. Then, and only after the latter has risen to its maximum speed, the cheetah runs the animal down with that tremendous speed which has no parallel in the entire animal kingdom. The cheetah's lasting powers lie somewhere between the cat's and the dog's.

This ancient sport of India does not affect the abundance of game, for no great number of buck are destroyed and the herds are plentiful. Furthermore, the animals that are killed are eaten as venison.

The country where the hunts took place was a large reserve of flat grassland that seemed literally teeming with black buck. The car called for us at half past six in the morning and we arrived an hour later, meeting the Maharaja who had come out with his wife, sister, niece, and a few Indian gentlemen. Although the Maharaja is a bold cross-country rider, it was customary to follow the cheetah hunt, if possible, from a brake, or light wagon. At this time of year, however, owing to the recentsness of the last monsoon, the grass was so high as to make the many blind ditches too dangerous for a brake, so we were to follow by motor. Two lorries had come up—one to supply us with tea and sandwiches, the other with the cheetahs and their attendant staff.

An unusual companion

Mutual pleasantries were passed over the teacups, but pretty soon we were ready and climbed into the cars. In one car went the Indian ladies and one Indian gentleman; in the other, Mrs. Cutting went in front with the driver and I was sandwiched between the Maharaja and another gentleman. By my feet was a hooded cheetah, and I uneasily recalled the advice I had been given not to disturb them. His keeper, sitting on the forward running board, a most precarious place, had the duty of handling the cheetah and at times getting out to have a look at trappy ground. Off we careened—sometimes on lanes but mostly across country looking for game—everyone holding on like mad.

Having found a herd, we maneuvered for a proper position, and then began the real strategy. It was desirable, should the herd be large, to get the proper males separated from it. This was accomplished by continually keeping them on the stampede,

for, as they did not run straight, by bucketing along at times up to 25 miles per hour we could keep up. Everyone was holding on grimly, but one needs two hands to a camera, and twice I landed on the cheetah, who seemed however to have his own troubles over the ditches. At just the correct time the car was stopped, the cheetah unloaded and hustled out onto the grass. His first movements were slow. He had to find the game, then he started toward it at a gentle lop that seemed slow. We stopped a hundred and fifty to two hundred yards from the black buck on slightly elevated ground, and they began to move off gradually. As the cheetah approached with increasing speed, so did they start to hurry. Their bounds ceased and they started to straighten out into full speed. But by now the cheetah had chosen his buck and was also at full speed, an incredible speed, so that from this moment inside of ten seconds it was over.

I spill at top speed

The bucks, realizing too late that they could not match the cheetah's pace, attempted a downhill slope. There the latter is at a disadvantage because, should he make a poor leap to strike, he is subject to a painful tumble. What he prefers is an upgrade, where he makes every effort to reach the buck. One cheetah went into a blind ditch at full speed and took a bad toss, turning head over heels. He was given a bit of a rest, cleared of the dirt and mud that were on his head, given a drink and was tried again, but he would not run.

The method of the kill is as follows. Having reached the right distance, the cheetah springs so as to strike with both forepaws the hind quarters of the buck. The violence of this blow throws the buck down, and he immediately seizes the throat. Unlike the attack of other big cats, the cheetah chokes his prey to death. As a rule we reached the scene just before the death. When the cheetah completes his job, he releases the throat, and proceeds to the hind quarters where he always begins to feed.

One killed a female, a regrettable incident, but he was dragged off his feed when he had just begun, so that he would never do it again.

Each of the others was allowed time for a good feed, then taken back to the lorry where he was exchanged for another—and off we went again. There was always a delightful bit of variation in each hunt

as sometimes the staff work of maneuvre took quite a while and we had the spectacle of a racing herd close at hand which we would soon lose and then pick up again. Also the cheetah would be loosed at varying distances, that enabled us to watch his method of approach and attack. One element never varied. Once the cheetah got streaking out the show was quickly over.

My wife and I had shot the true carnivora—tiger and leopard—but never had we seen the cheetah alive over its kill. At such a time the cheetah lies at full length with the buck's throat held tight in its slightly curved canines by a bulldog grip. The buck's violent attempt for freedom gradually subsides as he is choked, while the cheetah lies perfectly still in apparent ecstasy, slowly opening and closing his great greenish eyes and gently emitting a soft rumbling purr.

By eleven o'clock in the morning we were through, and seven cheetahs had overtaken animals. And so the cars and lorries all started off to a bungalow resthouse. There, with the Maharaja, we partook of a delicious breakfast while everyone made merry, chatted and viewed the kills, or rather what remained, which had been laid out on the grass.

His Highness, who is one of the first sportsmen of India and a most generous and thoughtful host, had accommodated us with an impressive demonstration of the fastest animal on earth in action. The only difficulty was due to the season. The southwest monsoon rains, which had only recently stopped, had left the grass so high that many of the ditches were invisible and so dangerous.

Speed

One last word with reference to the cheetah's speed. To begin with, consideration must be given to the fact that when one is apparently running fast he is by no means necessarily running his fastest. Any one who has become familiar with cats will appreciate how very difficult it is to train them in anything that is out of the ordinary, owing to their peculiar temperament. A cheetah most probably would never run his maximum on a track. Furthermore, it is doubtful if a cheetah would sustain his greatest effort for distances of two hundred yards or more. But in his natural habitat, when pursuing a buck, his final burst is terrific and must surely attain a speed of 65 to 70 miles per hour for a 100 yards.



ONE OF INDIA'S ANCIENT sports is the hunting of black buck with trained cheetahs, the world's fastest four-footed animals. Although very popular with Mogul conquerors centuries ago, it can be witnessed only in a few localities today. Above is a 19th century French artist's conception of the hunt. As in fox hunting, sportsmen take no

actual part in the kill, merely "following the chase." Cheetahs hunt by vision rather than scent, and are, therefore, hooded like falcons until the prey is sighted. Unlike tigers, lions or leopards, the cheetah does not need to steal in close for a short charge as depicted above. Conscious of its superior speed, it lets the fleetest buck get a good start, then runs it down

PHOTOGRAPHS BY SUYDAM CUTTING



(Above) 500 DOLLARS' worth of hunting cheetah owned by the Maharaja of Kolhapur, one of the few remaining devotees of the sport. Wild cheetahs are captured in Asia and Africa, the latter variety being bigger and faster. Thirty-four other cheetahs occupy this "dormitory," each on his individual *charpoy*, or native bed



(Above) TWO PERSONAL ATTENDANTS are assigned to each cheetah. The cheetah can distinguish the darker male buck from the lighter female and is trained to kill only the male. As part of this training, the men who feed them always wear dark robes, while the regular attendants do not. Curiously the cheetahs take kindly to their keepers

(Right) HOODED and tied to his *charpoy* (native bed), the cheetah is carried to the game fields

(Below) HIS HOOD REMOVED, the cheetah lopes off in pursuit of the herd



(Below) BREAKING INTO HIS HOUND-LIKE STRIDE, he singles out a black buck and prepares to run him to earth

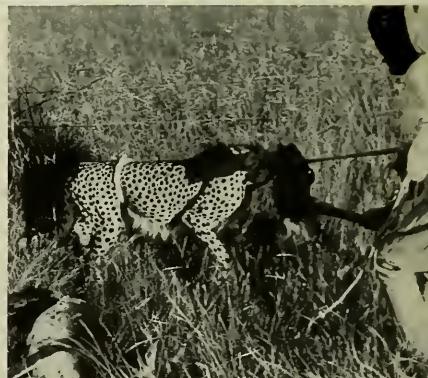


(Below) AT FULL SPEED the cheetah is rapidly overhauling his quarry



(Above) THIS WAGON ordinarily carries trainers and cheetahs to the hunt. Recent monsoon rains obviated this method during the author's visit. His party rode in automobiles, sipped tea, and snapped these pictures of the chase

CHEETAHS DO NOT REND AND BITE their quarry, but seize the throat, bull-dog like, choking the animal to death. The vexed trainer drags the cheetah away from its meal when, contrary to training, it attacks a female



(Right) MAHARAJA OF KOLHAPUR and Mrs. Cutting beside a cheetah and his kill. The meat is eaten as venison



(Right) PORTRAIT OF A CAPTIVE CHEETAH. Despite the cat-like head and muzzle, the paws are like those of a dog. They are purely running mechanisms equipped with heavy pads and blunt non-retractable claws

Wide World Photo



Globe Photo

(Above) A PAIR OF SPEEDSTERS running with their characteristic greyhound gait. The cheetah is the only member of the cat family equipped to run in this loose-limbed fashion

Wide World Photo



(Left) CHAMPION SPRINTERS of four-footed animals. When pursuing a buck, his final burst of speed is terrific, attaining the rate of 65 to 70 miles per hour over 100 yards

THE ENIGMA OF THE SQUAW-MAN—*Mixed marriages on the reservation frontier and their outcome. Further reminiscences of a field anthropologist*

By CLARK WISSLER
*Curator of Anthropology
American Museum*

ALMOST without exception, when traveling on the reservations, if I called at the home of a white man with an Indian wife, my host sooner or later offered apologies. Such unexpected behavior led me to wonder about the social and economic implications. Obviously the squaw-man was aware of the contempt in which he was held by those of his kind married to white women, but let me take you on a visit to some of these enigmatical homes on the old-time reservations.

On a certain reserve, I often heard about the ranch of Sid Lee and was advised to find an excuse to spend a night there. In due time it became convenient, and following the directions given, I came in sight of Sid's place. It was an impressive plant, with numerous corrals, many wire fences, a string of cattle sheds, a row of log stables and several clusters of one-story log cabins. Fences guarded the property on all sides, but an open roadway led to the stable yard, where a young English-speaking Indian met me. He informed me that Sid was not at home but was expected soon, and that it would be quite all right for me to remain for the night.

An unusual reception

He thereupon led the way to a row of log cabins and, opening a door, showed me my bed. It was a bare bunk-frame, and there was nothing else in the room except a broken-backed chair and part of a mirror on the wall. Of course there was nothing wrong about this—it was a good dry cabin, one could bar the door and slide into his bedroll as elsewhere—but it was not quite what I had expected. While looking the place over, I heard a commotion at the stables; someone was being bawled out in strong language. Next there were vigorous strides and the jingling of spurs. The door flew open, and a tall, muscular, dynamic man stood before me.

Without pausing for an introduction he said,

"Come out of here!" I was taken aback. "This is no place for a gentleman," he went on. "You are to go to the house. I apologize to you for this insult. These d—d Indians never learn anything."

Obviously this was Sid. Later he explained that he was so angry at his Indian employee that he forgot to be polite, that he had heard of me and that I was headed for his ranch. (In time I learned how impossible it was to approach his place without being spied upon and without one's presence being relayed to Sid.)

Luxury

The ranch house was a series of log cabins arranged around a court. Not having the privilege of exploring the whole place, I cannot describe it fully. It appeared that there were at least twenty units or rooms. We entered directly into a large living-room, surprisingly luxurious, beautifully polished wood floor, good oriental rugs, correct up-to-date furniture and a grand fireplace. But Sid led the way to a side door which opened into a perfect bedroom, resplendent with bird's-eye maple furniture and, best of all, a real bathroom. This was luxury.

Sid excused himself on the ground that it was necessary for him to see about my grub. It was pleasant to lounge in a great soft chair before the wood fire which someone, possibly Sid himself, had kindled while I was in the bedroom. About an hour later, Sid returned with the brisk announcement that we were to eat. We crossed the open court and entered a large room, severely plain. In one end was a huge wood-burning range flanked by shelves bearing cooking utensils, toward the other was a plain table covered with oil-cloth and literally packed with food. There was a large platter containing some twenty fried eggs, another covered with ham and slices of bacon, then dishes of beans, fried potatoes, stacks of bread, etc. It was a large table, as may be expected, but what held the attention was that only two chairs were set, one on each side.

Sid motioned me to a chair opposite the range, where I sat facing him, the wealth of food between

us. To say that I was perplexed is to put it mildly. For what, in the name of all the great Indian medicine men, could two men do with so much food!

Seeing my hesitancy, Sid said, "Take some eggs." I took one.

More emphatically, "Take some eggs!" I took another, remarking that two fried eggs were about my limit, to which Sid replied, "H—l, I intend to eat half of them and expect you to eat the other half!"

I was hungry, terribly hungry, but I made a sorry showing. Sid had been riding the range all day without lunch, and how he did eat! Noting that neither cooks nor waiters were in sight, I inquired as to who was responsible for this meal. To my surprise, he apologetically admitted that he had done the most of it, not daring to trust those d——d Indians when he had company.

Eventually we returned to the living-room, settled ourselves before the fire, and talked. Among other things I remarked that I was interested in bead work, upon which Sid asserted that the "Old Woman" had some. He left the room at once and soon returned with a young Indian female. She giggled as Sid presented her, then sat down upon a couch. She looked like a full-blood, too well fed and too lightly employed to show a pleasing figure. Her dress was plain but clean, and her face was pleasant. She began taking beaded moccasins, etc., from a bag, and, realizing that it was up to me as a guest to carry the thing through, I selected a few objects. I asked Sid what I should pay, but he said that it was her property. So I bargained a little, then paid what she asked. She quickly thrust the remaining objects into her bag and withdrew.

Sid began to make apologies. He said that his first woman died recently, that she was not much to brag about, but the best to be had; that the younger generation of Indians was not up to standard, and though, for his present wife he had taken the best one he could find, she was a poor substitute. "But," he said, "what is a man to do in this country but take an Indian woman?"

Economic aspects

We agreed that the natural thing to do was just that, though privately we reasoned that unless Sid married an Indian woman he could not live on the reservation and operate a ranch there. All the riches of his ranch were by legal fiction the property of that Indian girl, but in reality owned by Sid. He paid no rent, no taxes and could stock the whole reservation.

We talked of his children to whom he seemed

greatly attached, three girls and a boy. They were in a boarding school in California and had not been to the ranch for a long time. Sid went out to see them regularly, was trying to bring them up as white people, and hoped that they would find a place in a white world. I would like to know how this noble experiment came out.

When bed-time came Sid announced that he expected to leave early in the morning, far too early for me, but that his white ranch foreman would fry me some bacon, etc.

So, like all the characters in these reservation sketches, Sid takes his turn upon the stage and vanishes into the wings. I never saw him again, but learned that eventually the Indian office forced him to reduce the size of his herds, an outcome which he doubtless expected, and that finally he was liquidated, left the reservation, presumably to live with his children. No doubt his going was a misfortune to all the Indians whose living depended upon him, but since he was exploiting Indian land in the name of his wife, the law was certain to get him sooner or later.

Not infrequently when I inquired about a white man I had not met at an agency, the answer would be a sneer, "Oh, he's a squaw-man," or "Oh, he is a good fellow in a way, but one of those d——d squaw-men."

White derelicts

One need but note the emotional slant to these expressions to understand the social position of these white derelicts, and their embarrassment when we called at their homes. The unconventional wife could rarely speak a word of English. Why should these white men have made such sacrifices? This is the question we often asked ourselves. Sid's case was exceptional; his chief motive was economic. Yet every squaw-man of reservation days exploited his woman in a way, because, if industrious, he lived on her land, raised cattle and horses in her name; if lazy, he lived on the rations she drew by her ticket. But it was not the fact that these white men were slick enough to get their living from the Government and the Indians, that roused the indignation of their conventionally married fellows, for they, as officials or traders, were grand masters of that game. The iniquity lay rather in not playing the game in the conventional way. Further, living outside the pale of social respectability, the squaw-men made friends with their Indian male relatives, and without official approval informed them as to their rights and the true state of affairs at the agency. Need we say more?

History shows that the mere marrying of Indian

women is an ancient and honorable custom, for did not one John Rolfe, landing in Virginia, initiate this by marrying the daughter of a chief? Captain John Smith must have liked Rolfe, because he consented to be his publicity agent and in the story of Pocahontas produced a classic still the admiration and the envy of all press agents. Yet Rolfe had his troubles; King James did not approve of the idea, for though quite willing to receive Pocahontas as a Princess, he balked at recognizing her husband and thus elevating him. The question in his mind was "Why did not the Chief, as the father of Pocahontas, consult him: he would have picked out a man of royal blood. And how dared one of his subjects marry a Princess without his consent?" So the first squaw-man had his troubles. His King frowned upon the marriage and his less fortunate brothers hated him for his luck. Yet, Rolfe had something in the way of compensation for he won immortality and gave to the F. F. V.'s a line to be proud of, which is more than can be said for the fellows who married those white "jail-birds" sent over to the Virginia colony. Historians tell us that we live by precedents, and if so, this explains the whole thing. Because since noses were turned up when Rolfe took an Indian wife, every squaw-man from that day to this has of necessity been an object of suspicion. Yet the historian may be wrong, for as a schoolboy, we accepted Captain Smith as a hero, we adored Pocahontas, but failed to enthuse over Rolfe. Perhaps there is something constant in human behavior after all.

The second picture to intrigue me was in different colors.

Squaw-men were not always white. But if a man of color married an Indian woman, no one seemed shocked. White people merely felt sorry for the woman, apparently believing that while the white man always married down, in the other case the man always married up. Somehow this shifting in values always left one in doubt, because many Indian women we knew seemed to have married down when they took their white husbands.

A "squaw-chink"

I heard a lot of talk about Ping Shoo's Hotel, how the beds were immaculate and meals unsurpassed, and was advised never to pass up a chance to spend a night with this famed "squaw-chink." Like an oft-repeated advertisement, this propaganda broke down my initial resistance, and I came to have a secret, guilty longing for the luxuries of this hostelry, guilty because I was out to see the Indian country, not to visit in Chinatown.

Fate was kind, for one day I saw in the distance a two-room log cabin, and, drawing near, read in crude black letters, "Ping Shoo Hotel," on an unpainted board over the door. Entering, I found myself in a common room, on one side a rough table, with board benches, on the other a rusty stove and a few broken chairs. Obviously, this room was dining hall, lobby, and office combined. Presently an inner door opened, and a typical Chinaman entered, saying "Hello." He looked like the laundry man around the corner back home, in fact dressed just like him.

I asked if he was Ping Shoo and he assented, but ignored my remark that I had heard of Ping Pong, with, "Wantie eat and sleepie? Good, takie chair, suppy quick." With the last word he vanished through the door.

This gave opportunity to look around. The cabin stood alone, without fence or tree. Hearing chopping, I looked around a corner at a sizable wood pile, and saw that Ping was swinging the ax. Presently the familiar odor of wood smoke was recognized, soon followed by the tantalizing odor of frying bacon. In the distance stood a tipi around which a few children were playing, which I judged were his. I could not help wondering about the eyes of these mongrel children, but even through field-glasses, they were too far away for anatomical observations.

While waiting, I began to wonder where Ping kept his famous beds. Peeking through the back door merely added to the mystery, because range, utensils, etc., seemed to fill that space. In short, all I could see was dining room and kitchen furniture and very little of that.

Regular boarders

When the table was set, it became evident that other guests were expected, and it was reasonable to suppose that Ping Shoo's family was to join us, but not so. Presently a horseman arrived, followed by others. It was soon apparent from the commotion that these were regular boarders, and government employees at that. The supper was splendid, though served in simple style. It came in courses, but a large reserve was placed in the middle of the table from which everyone was free to take. Never in all my travels have I sat with regular boarders who uttered such praises of their cook. And in the same spirit I, as guest, was so often urged to commend the food that I seemed to be eating and making an after-dinner speech simultaneously. It was most unusual.

After the boarders left, Ping lighted a coal-oil lamp and left me to my devices, but in time he ap-

peared with, "Go-bed?" Joyfully I accepted this invitation, now the mystery would be solved. Picking up the lamp, he conducted me into the kitchen, and I noticed for the first time a curtain across one end. Behind it was a white iron bed with fresh white sheets. It was a real bed, just like we had at home. This was what had given Ping Shoo's Hotel such a reputation.

When I took my leave the next morning, I could not forbear a try at Ping for a note to put in my field book, so asked him how he liked an Indian wife. His reply was, "All samee."

Well, hats off to Ping Shoo; he made no apologies.

You should understand that when a white man went to live in the reservation country, where single women were scarce, he had to take what he could get. And if he drew a dumb-bell, he was apt to try again. Ben Coldwater, for instance, over seventy when I first met him, had his fourth Indian woman and could boast the ancestry of three generations of mixed bloods. When I called upon Old Ben I noted a poor sort of cabin, with a sod roof and an earthen floor. It was no better and little worse than those occupied by the older Indians. Presumably, it was equal to anything Old Ben had ever called home. He desired nothing different. When occasion permitted he went on a spree, but at other times was a good talker, and many times we heard him tell stories of adventure which as examples of artistic lying, deserved preservation. He liked to gamble and now and then cheated an Indian out of a few dollars, but in the long run lost as much as he won. He was not excessively cruel to his family. He had but a few head of cattle and a couple of horses, so could not be accused of exploiting the Indians, nor could he be credited with trying to uplift them. What was conspicuously charged against him was that he was the ancestor of several exceedingly troublesome and worthless mixed-bloods. He was never heard to complain of anything, probably because he was too busy magnifying his own adventures.

Life-long infatuations

Not infrequently it is asked whether these white men loved their women, or were such unions merely selfish and sordid. On the one hand there come to mind examples of life-long infatuations such as one may meet anywhere; on the other there are many instances of selfishness and greed. There was a soldier, graduate of a military school, who while on duty in the West fell in love with a young "barracks squaw." She would stay with him for an interval, then desert to another, but always he la-

bored until he got her back. Finally, finding that the service would take him where this coquette would not go, he resigned his commission and lived with her on the reservation. She still indulged in occasional lapses, even eloping to other reserves, but each time he either induced her to come back or waited impatiently until she did. I knew the couple in their old age and the man still adored her. To me she appeared as a shrewd, naughty but likable woman.

The old-timers at a certain agency told me how a slender, lively, bright full-blood Indian girl once led the unmarried white men a mad race, now flirting with one, then another, and according to report was a frequent sex offender. One of the government clerks with a wife and children fell in love with her. The girl consorted with him and jilted him by turns, but his infatuation seemed to grow. Finally he told his wife to move out, that he could no longer do without the Indian lady. This brought matters to a head. It was too much for the major, so the clerk was fired. Thereupon he eloped with the Indian girl, but in a short time she left him to take up her old life. The ardent lover got a divorce from his white wife, eloped once more with the girl, and married her. They then returned to the reservation, as was her right; they were a childless old couple when I knew them, living happily so far as could be seen.

Perhaps this is sufficient to bear out our general conclusion that the much-abused squaw-man was a cross-section of men at large, good, bad, and indifferent. Some strong and good men lost their hearts for good when they struck the Indian country, making the supreme sacrifice, if such it can be called. Some were beastly and heartless. The great majority were just calculating, ordinary mortals.

The white-squaw

Now look at the other side of the picture, the white-squaw. The reader may be astonished that any white woman would willingly marry an Indian, but such marriages are on record. One notable example coming under my observation was that of a French woman who married a young full-blood Indian employed by a traveling show. Obviously she fell in love with him and married in a hurry. They returned to the reservation, put up their log cabin and began life in the usual way.

The man was rather dull, loved ease and fine clothes. He showed neither ambition nor power of leadership but behaved as something of a snob. The white wife, on the other hand, seemed aggressive, sensible, honorable and business-like. To see her

walking about the agency was to recognize that here was a person possessed of executive ability. The white people called her Maxine.

The first time I saw her she was at the agency directing the delivery of several wagon-loads of hay to the government stables under contract. An immaculately dressed Indian standing about stiffly and doing nothing was pointed out as her husband. He must have put on a freshly laundered shirt every day, for we never saw him dressed otherwise—the only and truly stuffed shirt among Indians. Maxine was then the mother of half a dozen children, some of marriageable age. They were handsome, well dressed youths, but in Indian style. One might easily have thought them full-bloods, because of their conservative Indian behavior, especially their haughty bearing.

Maxine was the owner of a large herd of cattle, several hundred horses, corrals, feeding sheds and the equipment for cutting and storing hay.

The trader, who like a village banker knew the financial status of every one around, volunteered the information that Maxine carried the check-book and that her man had to ask her for an order on the trader for tobacco, etc. Further, her credit was said to be good for \$10,000 any day.

Opposite reactions

In short, this is the reverse side of the picture; a white woman exploiting the lands of the Indians in the name of her husband. Strange to say, we heard no sneers from the agency white men; all took off their hats to Maxine. But the things they said about her Indian husband cannot be set down here. On the other hand, the white women at the agency had nothing good to say of Maxine; if anything, they pitied her husband on the ground that somehow he was basely imposed upon. From all I could gather, he was deeply in love with his wife, proud of her achievements, and enjoyed her wealth with a clear conscience. Though I met both many times, neither offered explanations nor apologies.

Another woman I have in mind was a mulatto whom the white people called Mrs. Redclay because she was the widow of an Indian by that name. She was as poor as many Indians but lived in a neat log-cabin at the agency, dressed plainly but becomingly, spoke good English, was skilled in conversation, respected by whites and Indians alike.

Mrs. Redclay was said to have been a captive, or rather a stolen child, brought up as an Indian. Apparently she considered herself Indian and, of course, made no apologies. She received rations as an Indian widow and supplemented this by doing

sewing for the white folks. Her cheerfulness and sincerity inspired our admiration. She had no complaints to offer. Several dusky children and grandchildren were her contribution to the world. One of her sons was a natural leader and destined to be a chief, the white-negro-Indian blend in his case producing a countenance decidedly Indian in appearance.

But why go on with these instances, for as we see it neither the squaw-man nor the white squaw needs defense. In reservation days the squaw-man had to be legally married or move away, and if his conduct became too outrageous he was evicted from Indian lands and thus separated from his Indian wife and children. Few agents would lose any sleep over such forceful disruption of marriage ties; on the contrary, they would have felt that justice and propriety were advanced thereby.

"Breeds"

Most squaw-men gave to the world a flock of hybrids, and though these were legitimate in the eyes of the law, they were probably neither better nor worse than the more numerous "breeds" resulting from illegal unions. One saving grace was that the full-blood Indian seemed to see nothing exceptional or degrading in either case, possibly because though at times an incomprehensible idealist, for the most part his social realism knew no bounds. If he disliked "breeds" at all, it was only when they became snobbish and considered themselves superior because of their white ancestry.

On the other hand one did not need to tarry long at an agency to learn what the white people thought of them, for it was everywhere, "those good for nothing breeds." As one veteran major said, "Give me the full-blood every time. He drinks less, tells the truth, has moral principles by which he stands, and a mind you can reason with. On the other hand the 'breed' has no such qualities, he is a trouble maker without morals or principles. He respects neither white nor red."

Note that the major said, "he." I never heard an official raise his voice against the female "breed" as a class, nor could I see that she presented a problem. True, now and then I heard of a gay lady who preyed upon white men, but there were full-bloods who did likewise, whereas the mass of hybrid girls were set to Indian ways by their mothers and grandmothers, married for the most part to full-blood men and so back-crossed, to use a phrase coined by the experts on the famous fruit fly. So far as I could observe, the mixed-blood woman was content to chop wood, scrape skins and bear children, like other Indian women. Possibly if I had

Continued on page 235

THE MYSTERY DINOSAUR—*Footprints of a giant with a 15-foot stride and estimated to tower to a height of 35 feet, are among the valuable specimens brought back by the American Museum-Sinclair Expedition of 1931*

By BARNUM BROWN
Curator of Fossil Reptiles
American Museum

MANY skeletons and something of the life history of dinosaurs are fairly well known from the Jurassic period dated some 140 million years ago, and from the end of the Cretaceous period when dinosaurs became extinct some 60 million years ago, but between these times there is an interim of many millions of years during which our knowledge of this great group of extinct creatures is vague. This is especially true of the time represented by the extensive coal measures of Wyoming, Utah, and Colorado, known as the Mesaverde formation and dated approximately 80 million years ago—and previous to our work last summer no dinosaur bones had been collected and none have been described from this formation.

Footprints in coal

The Mesaverde formation, covering hundreds of square miles in southern Wyoming, western Colorado and eastern Utah, is an extensive series of sandstones, clays, and coal seams that in some places aggregate a total thickness of more than 3000 feet and are especially rich in plant remains. In the Rock Springs area of Wyoming, there are no less than seventeen veins of coal ranging from three to fourteen feet in thickness, and many veins too thin to be of commercial importance. The Union Pacific Coal Company, mining exclusively for the Union Pacific Railroad, alone produces approximately four million tons of coal per year and supplies the major part of the coal used on the entire Union Pacific system extending from Omaha to Los Angeles.

BARNUM BROWN, who first joined the Museum in 1897, has for forty years conducted expeditions over North and South America, the West Indies, Africa, India, Burma and Turkey. His explorations have extended almost from the Arctic to the Antarctic, and on one series of expeditions he was absent for five years. During the World War he was engaged by the Treasury Department to establish methods and

standards for determining the depletion and depreciation of oil properties for purposes of taxation. Among the many adventures of his varied career he once fell into the crater of an extinct volcano in New Mexico, and another time was shipwrecked and marooned south of Tierra del Fuego. Doctor Brown took out the first dinosaur skeleton excavated by the American Museum of Natural History, and

though his collecting subsequently covered a wide range of subjects from plants to mammals, he has in later years been centering his efforts more and more on dinosaurs. He has found dozens of new types of dinosaurs and has developed many new methods of excavating and interpreting fossils. Much that is known of the Age of Dinosaurs is a result of the hundreds of tons of bones he excavated.—THE EDITOR.

Aside from their gigantic size the most interesting feature in these larger Mesaverde tracks is that they were made by dinosaurs having a single toe pad on each digit, which in form is identical with smaller tracks known to have been made by the *Iguanodon* dinosaurs of Belgium and England—dinosaurs that walked upright like a kangaroo. The toes of Trachodonts (duck-billed dinosaurs), also upright forms, so well known from Canada and the western states, show that these related creatures had three pads on each digit. By some writers the Trachodonts and *Iguanodonts* have been considered closely related, but the skeletons show that they represent distinct families.

For several years huge dinosaur tracks in the Union Pacific coal mines at Rock Springs, Wyoming, have been known to the writer, and in our aerial flight in 1934 we stopped at Rock Springs to again examine these tracks. During this survey my attention was called to some fragmentary bones found by Mr. Bud Meacham on a nearby hill. These bones were so near the town that at the time I could not risk even a preliminary investigation for rabbit hunters prowl the hills continuously and inquisitive amateur collectors have ruined many good specimens. This prospect, however, and two others, were marked for future examination.

The evidence of the large tracks and known prospects were presented to our patrons, The Sinclair Refining Company, and they again aided our dinosaur work by financing an expedition for the purpose of collecting in this hitherto little known formation—not only because dinosaur remains from this coal measure series would be of the greatest scientific interest, no skeletons having ever been found there, but because the huge tracks of this mystery dinosaur seem to appear only in the Mesaverde formation and a search there offered the possibility of securing larger skeletons than any heretofore known.

Large mechanical excavator used

Officials of the Union Pacific Railway also were generous in their support, giving free transportation over their line to the personnel of the expedition and any collection secured; also the use of a large dragline shovel for a period of two weeks to assist in excavations and permission to excavate on any of their coal properties that extended for 20 miles on either side of the railroad.

Some of our members traveled from New York by car and the party which finally assembled included the writer, Mrs. Brown, Dr. Erich M. Schlaikjer, Mr. Roland T. Bird, Mr. Robert G. Chaffee, Mr. Gil Stucker, Dr. G. Edward Lewis, Mr. G. D.

Guadagni and Mr. James Ryan. As arranged with the railway company the drag-line equipment, loaded on three cars, arrived promptly at Rock Springs ready to start excavating. So far as I know this is the first time a large excavator has been used for uncovering fossils, and it proved to be most efficient. With it we were able to move a cubic yard of earth every fifteen seconds—and do the work accurately. The shovel was set up over our first prospect and it was uncanny to see how accurately the skilled operator could handle this enormous shovel, cutting close above the bone layer as directed.

In three days' time we had made an excavation equal to the work of a team with plow and scraper working three weeks. Unfortunately, the fragments exposed in this bone layer continued to be nothing but fragments and the first prospect was abandoned. We then uncovered two other prospects with the shovel, finding only a badly broken fragmentary remnant of a Ceratopsian skull. At the end of two weeks all of our prospects, found up to this time, were exhausted and the shovel had to be returned to the railroad company. A mechanical shovel can be used with great accuracy and is such a time saver and so economical to operate that we hope future dinosaur expeditions may be supplied with a smaller shovel of this type.

"Dinosaur bowl"

Rock Springs is located on the western border of the great Baxter uplift—an egg-shaped structure 65 miles long north and south by 35 miles across east and west. The central part is eroded down to a level exposing marine beds of older age, while the flanks are composed of the rugged upturned edges of the Mesaverde coal measures.

After a few days spent in preliminary prospecting we found that bone fragments appeared occasionally on many of the hills and we soon learned that the bone layer was restricted to a zone not more than 300 feet thick, overlying a massive sandstone below and covered invariably by a layer of large oyster shells above—evidence of a recurring sea, and a sequence which continued around the entire uplift. Veins of coal and layers of plants occur in this zone, also above and below it, and it seems certain that many of the animals whose remains were covered by plant layers must have been destroyed by acid during the formation of the coal. Individual leaves and masses of plants of many kinds were found at different levels, with some layers of ferns as delicate as Bird of Paradise feathers.

This season proved to be different from any in my experience, offering many problems difficult to solve, such as water sources limited and far apart, wind

and dust storms, and working long distances from camp.

As it was impractical to camp in town, we finally located a good spring at the foot of White Mountain, six miles from Rock Springs and near radiating highways. Here we pitched our tents and with the cars could drive to the foot of the hills where each man would take a given section and carefully search every foot of the ground.

Never, except in Patagonia, have I experienced such wind and dust storms and occasionally rainstorms. Frequently on returning to camp we would find one or two tents blown down and had it not been for Mrs. Brown and the cook in camp, on several occasions all of the tents would have been blown away.

Fortunately, there was a group of unoccupied buildings nearby, one of which had been used as living quarters where a still was operated during prohibition days. We were thankful to occupy these buildings, re-roofing one as our commissariat, and made this spot our permanent camp throughout the summer.

The limited thickness of the bone layer permitted exceptionally rapid prospecting, and as much of our work was 30 to 40 miles from camp, we would travel as far as we could with cars and frequently walk several miles over rough ground before a day's work was accomplished.

The heat and the dust and the winds of the day taxed one's endurance, but twilight would bring an end to nature's strife—following in sharp contrast with still, cool, glorious nights, when the stars seemed bigger and brighter than elsewhere. Then the lights, like jewels, made intimate the distant city and the mining camps on the hills, while the airline's flashing beacon gave a feeling of peace and security to the night. Through liners regularly droned above us, and when a ship did land at night, the airport in the valley below—with flood-lights bounding the field and multi-colored line lights as colorful as a Christmas tree—presented a never-to-be-forgotten sight.

A new horned dinosaur

Eventually we began to find better specimens, although few were worth collecting, but one day the boys reported a horned-dinosaur skull. This was indeed a ray of sunshine for up to this time the success of our expedition was much in doubt. The skull proved to be fairly complete and it is undoubtedly a new species—the first of its kind known from this horizon.

Shortly afterward, 30 miles distant, we found a connected skeleton three-fourths complete, of a gi-

gantic Trachodont, a specimen that in size will probably rival the skeleton of the great flesh-eating dinosaur *Tyrannosaurus* that stands eighteen and one-half feet high. Our success was now assured, although we were still keenly intent on finding the beast that had made the gigantic footprints. This specimen was in an extremely difficult place to reach with the car and materials necessary for its excavation, but eventually, after several attempts our Ford truck zig-zagged to the site of the quarry on the summit of the highest ridge. The high ridge may have saved our lives on one occasion when Chaffee and I had driven the truck out to this specimen, while the other men were preparing the Ceratopsian skull. Storm clouds gathered in great masses, as often happened, but we continued our work, paying little attention to the distant thunder. Late in the afternoon, however, it began to rain in earnest. We hastily covered the specimen and took shelter in the cab of the truck. It rained so heavily that in the course of an hour the waters began to roar like Niagara in the creek beds on either side of our ridge. The heavy rains did not stop until nightfall, when we climbed to the highest point where we could look toward camp, and saw that we were marooned by rivers of water in the valley below. Our quarry was completely filled with water. We realized that the truck could not be moved for several days, and that the only way we could get back to camp was to cross one of the swollen streams and walk to a coal mining town where a car could take us to camp.

Left high but not dry

Neither of us had coats but before leaving the truck we made coats out of gunny-sacks, for the night was cold, and in pitch darkness waded to the stream between us and the town—only to find that the stream was an impassable rushing torrent. Our last resort was the bridge over the main stream three miles below, but on reaching this point we found the bridge had been washed away and there was nothing left for us to do but return to the truck to spend the night. We reached it, exhausted, long after midnight and then found that we had used up all our matches in smoking.

A happy thought came to Chaffee and starting the motor he short-circuited a spark-plug and ignited cigarette papers soaked with gasoline. With shavings from wood we carried in the car for reinforcing specimens we built a fire in plaster pans filled with rock. In this way we took turns in sleeping and tending the fire until morning. In the meantime, members of our party in camp were much concerned for our safety, not knowing whether we had been caught



THE LARGEST DINOSAUR TRACKS ever discovered were excavated from the coal mine shown above in western Colorado, as one phase of the work of the American Museum-Sinclair Expedition of 1937. The tracks were found almost directly under the crest of this timber-covered hill about 400 feet below the surface and 1000 feet beyond the entrance of the mine. Other similar tracks in this mine are being preserved in their original position by the Colorado Archaeological Society. This is the Red Mountain Coal Mine, three miles northwest of Cedaredge, Colorado, operated by Charles G. States and Clarence E. Hall.



(Upper right) DR. BARNUM BROWN examining a pair of smaller tracks which were excavated from the roof of the nearby Western Star Mine owned by Charles W. Rinehart. These tracks, measuring 28 inches from heel to toe and 28 inches across, were well defined impressions of the right and left foot of a smaller dinosaur which had leisurely walked along covering 8 feet in each stride



Photographs by
Barnum Brown and R. T. Bird;
not to be reproduced without per-
mission of the author

(Right) THE FIRST STEP in cutting out the 30-ton section of roof containing the dinosaur tracks: R. T. Bird drilling through 40 inches of sandstone with a coal auger. The slab of rock 17 feet long and 5 feet wide bore four enormous footprints, two of which are part of a trail where the giant Iguanodont had taken a step of 15 feet

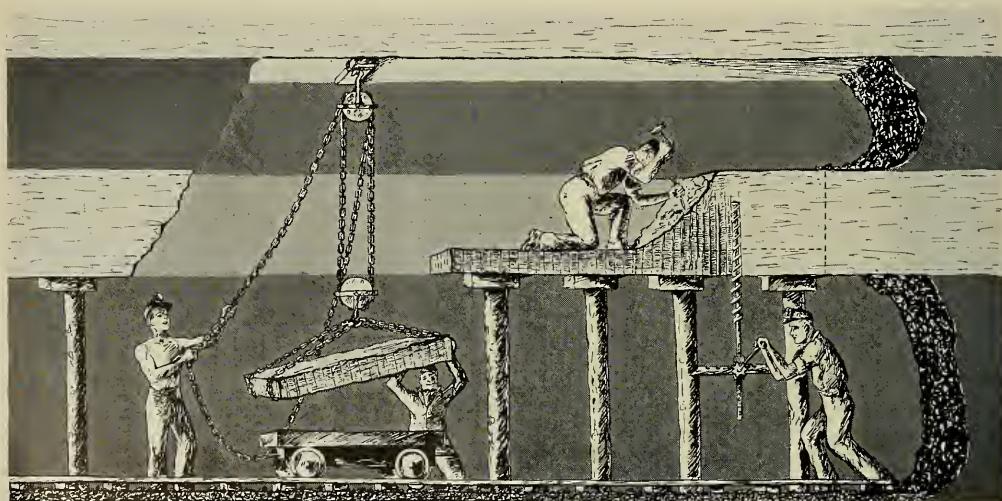


AMONG THE VISITORS to the mine were children from the Cedaredge School (*upper left*). One little boy, convinced although still quizzical, said: "Mister, I understand they are dinosaur tracks, but I don't see what position the dinosaur was in when he made them"—a pertinent observation that is explained by the model of the coal mine on the opposite page.

WHILE MEN were drilling holes from below, two men (*upper right*) mined out the five-foot vein of coal above and chipped away the upper surface of the sandstone containing the tracks



(*Below*) A DIAGRAM of the complete operation of removing the track slab, showing the two veins of coal and the intermediate sandstone layer. The first section of the slab is being lowered, the second and third sections are still in place. A man is reducing the sandstone above, and another is drilling holes from below



TO PROTECT THE TRACKS from damage, the entire slab was plastered with two or three layers of burlap, as shown below

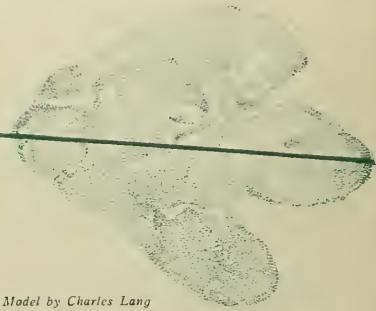
(Below) AFTER THE COAL and upper part of the roof had been mined out the remaining foot of sandstone was sawed through

THE FIRST TWO BLOCKS when lowered were not directly over the car and rails, and with lateral block and tackle were drawn in position



A Fifteen-Foot Stride

(Below) A MODEL OF THE MINE. The dinosaurs walked over decaying vegetation, and the last tracks they left in the soft peat later filled with wind-blown or water-drifted sand. During the succeeding ages the peat turned to coal, the sand into sandstone. Recently miners cut away the coal including the tracks, leaving the sandstone filling of the tracks embossed on the roof of the mine



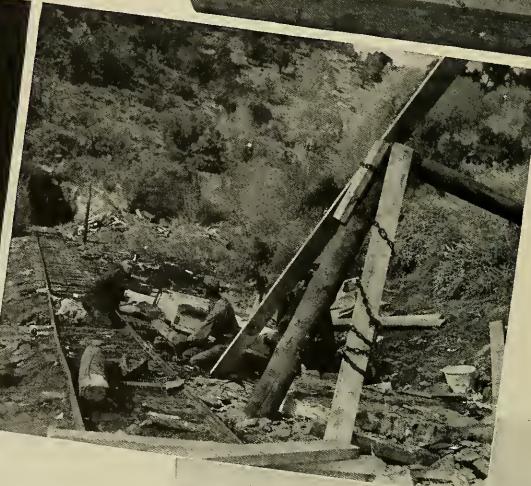
Model by Charles Lang



(Right) THE LONGEST normal walking stride on record: the three blocks assembled at the Museum in an inverted position, showing left and right footprints of a gigantic Iguanodont dinosaur which stepped 15 feet 2 inches, and must have towered 30 to 35 feet in height. Each individual footprint measured 34 inches in width and length, and the center block shows two other slightly larger similar tracks, parts of other trails, in which the roof of the mine abounded

(Left below) THE LAST BLOCK is lowered, leaving gaping evidence of the enormous task involved in securing just one single stride of the creature described above. To Charles G. States, mine owner, standing on the left, goes much credit for having made it possible for the Museum to acquire these tracks

(Center below) REDUCING AND CRATING the blocks outside the mine entrance, preparatory to shipment. The combined weight of the three sections thus prepared now totaled 8000 pounds



(Right) CROSS SECTION of a hillside near the States Mine, where prehistoric fires have burned the coal and baked the surrounding shales to brick-like hardness. The white layers are the ash of coal seams that were 3 to 14 feet thick. These shales are now quarried for road surfacing, a purpose to which they are most excellently adapted



FORTY YEARS AGO and today. While prospecting for new Mesaverde Cretaceous exposures in 1937, Doctor Brown revisited the classic Como Bluffs of Jurassic age near Medicine Bow, Wyoming. Photograph at top was made during the American Museum work in 1897; mammal quarry at left and *Diplodocus* quarry with tarpaulin at right

HERE IN 1897 Doctor Brown and Professor Henry Fairfield Osborn, discovered the *Diplodocus* skeleton, the first dinosaur excavated by the American Museum, and here the author first introduced plaster in excavating fossils. Note the fallen Dakota sandstone block which shows likewise in the modern photograph below



THE MYSTERY DINOSAUR

(Left) FORTY YEARS LATER. Doctor Brown found the timbered tunnel that had been dug above the buried skeleton partly caved in, but the wood flooring looked as though it had weathered only 5 or 6 years

(Below) IN CONTRAST with the laborious transportation of forty years ago, the 1937 expedition's caravan at breakfast time on the road to Cedaredge illustrates modern exploratory improvements





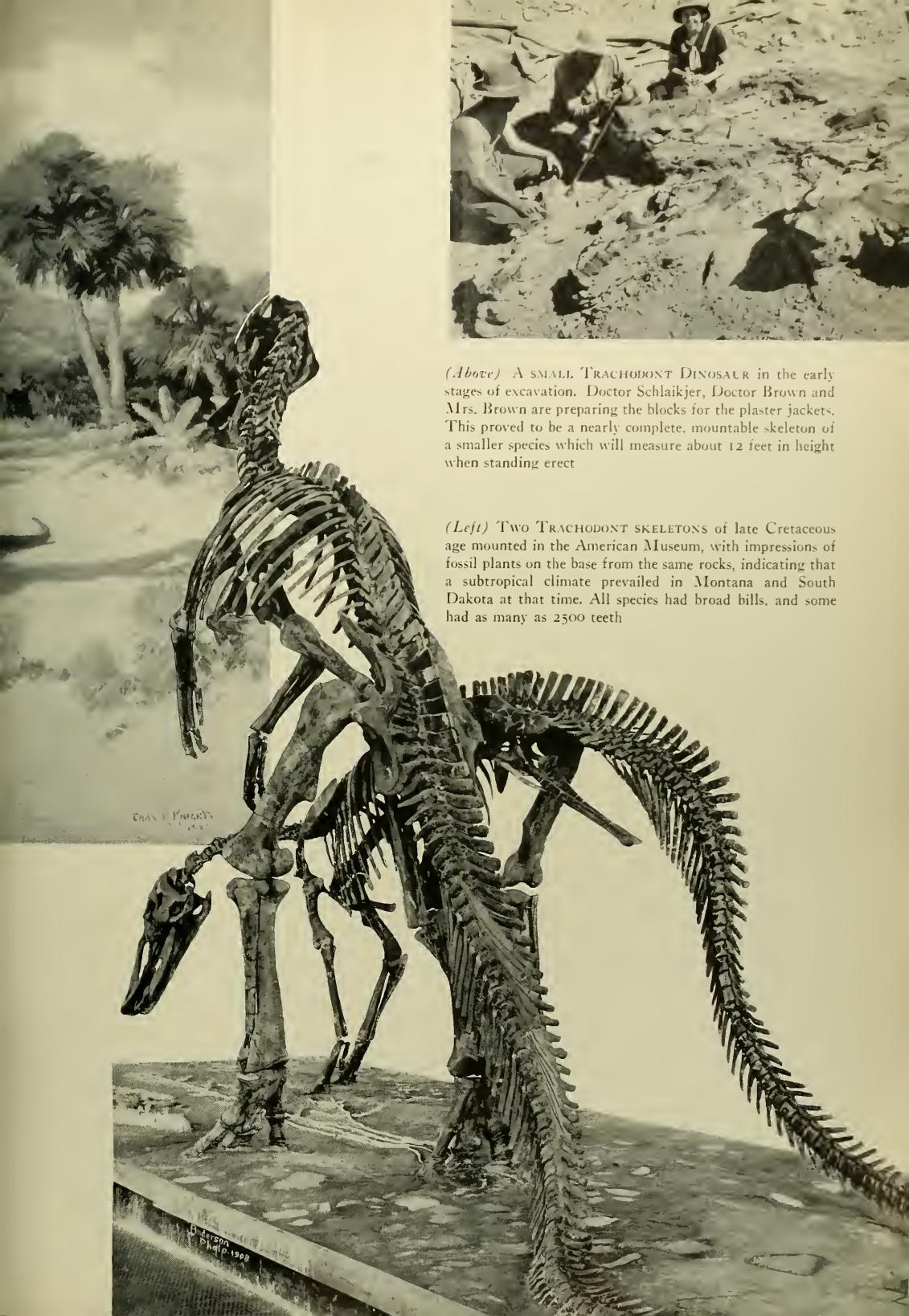
(At top) AIR VIEW of a section in southern Wyoming where the expedition exploring for fossil remains pieced together the story of Mesaverde times, 80 million years ago. The photograph, taken near Mud Springs, shows a part of the Rock Springs Uplift, whose vast accumulated measures are deeply cross-sectioned by erosion

From a painting by Charles R. Knight

DUCK-BILLED TRACHODONTS were the most numerous dinosaurs of Cretaceous times. Several more or less complete skeletons have been found with impressions of the skin disclosing various distinct patterns. Webbed front feet and partly webbed hind feet presumably assisted in swimming, as did their long, deep tails, useful also for balancing

A HUGE TRACHODONT skeleton in the early stages of preparation. Some of the bones have been blocked out and removed; other sections have been covered with plaster of Paris and burlap strips reinforced with wood. Succeeding sections are partly covered with plaster jackets or marked out for blocks. This specimen proved to be the largest duck-billed dinosaur found during the summer and appears to be larger than any previously known





(.Above) A small TRACHODONT DINOSAUR in the early stages of excavation. Doctor Schlaikjer, Doctor Brown and Mrs. Brown are preparing the blocks for the plaster jackets. This proved to be a nearly complete, mountable skeleton of a smaller species which will measure about 12 feet in height when standing erect

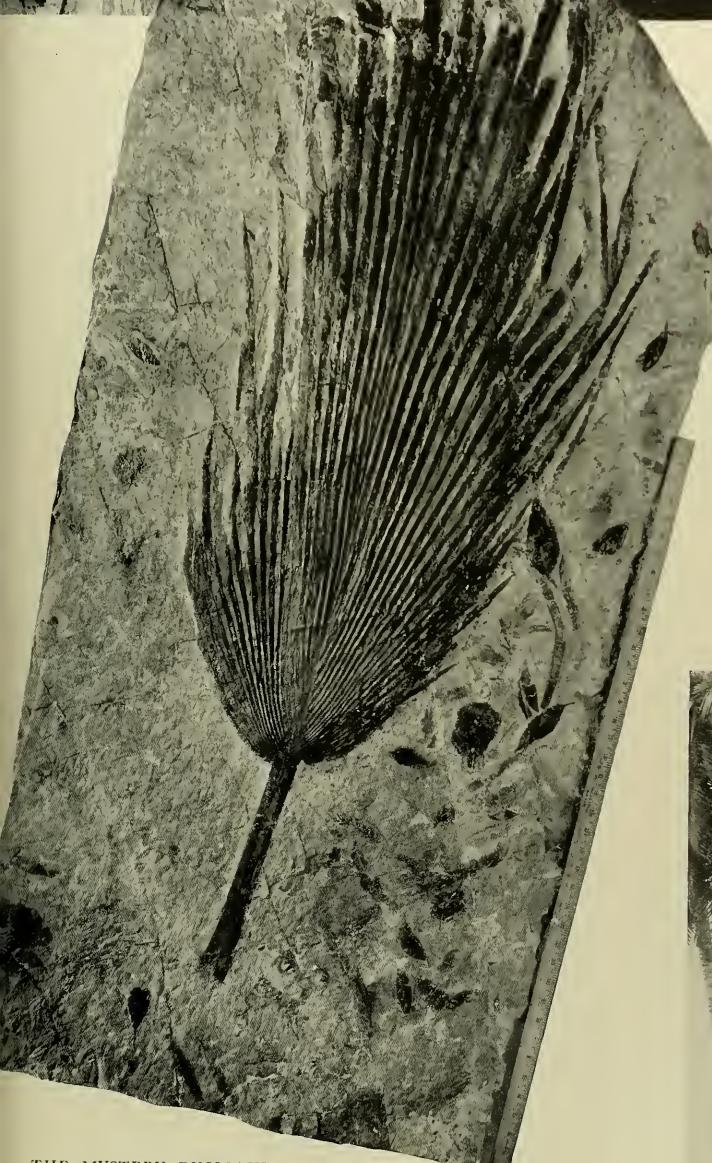
(Left) Two TRACHODONT SKELETONS of late Cretaceous age mounted in the American Museum, with impressions of fossil plants on the base from the same rocks, indicating that a subtropical climate prevailed in Montana and South Dakota at that time. All species had broad bills, and some had as many as 2500 teeth

(Right) A THRILLING FIND in the midst of dangerous surroundings: a partially exposed palm leaf impression discovered on the sagging ceiling of the "Tropical Room," part of a long abandoned section of the Red Mountain Mine. No one had ventured in these badly caved-in workings for many years, but the tale of an exquisite underground jungle of fossil plants lured members of the expedition in to make this new discovery, shown in detail at right

(Below) JUST HOW HAZARDOUS WAS IT? wondered Bill Fogg, the miner, as he stepped under the hanging ledge to show this potential prize to R. T. Bird. "Now let's get out of here," were his first words after the cameraman's flash registered the picture. Note the weight-splittered prop standing on the right, sole support of many tons of overhanging rock widely separated from the roof above



(Left) WITH THE LEDGE heavily retimbered for safety, a large block containing the palm leaf was plastered. This photograph shows the miners cutting through the surrounding sandstone preparatory to its removal. Nearly 1000 pounds of fossil plants were recovered from this one room



(Upper left) DRAGGING THE HEAVY PALM BLOCK up over the fallen roof of a room that had entirely caved in. On the way out of the mine several other rooms were negotiated where thousands of tons of such material seemed to hang by a hair

(Upper right) PASSING THE BLOCK out through the last portal that led into the present mine and safety. This concluded a very adventurous phase of the expedition's underground work

THE FOSSIL *SABAL* PALM LEAF resembles the living *Washingtonia* palm (below) and proves to be one of, if not the most perfect fossil of its kind ever recovered. Bird worked one month in the laboratory to clear it from the shaley matrix. On the same slab are preserved two extinct species of figs, a Waxberry, and branches and cones of an extinct genus of pine related to the living *Araucaria*



in the rushing waters or swept away by a cloudburst that was reported in that section. Rescuing parties were sent out during the night but they could not find us, and their anxiety increased until late the following day when we finally reached camp. This was the time that newspapers reported Chaffee and myself lost in a cloudburst.

Shortly after this episode a small Trachodont skeleton was found 40 miles north of camp, proving to be the most perfect of all of the dinosaurs discovered last summer, as the bones are practically uncrushed. This is a connected, practically complete skeleton, that will stand about twelve feet in height when mounted.

High up on a steep hillside near Point of Rocks, 40 miles east of Rock Springs, we found the most interesting specimen of the collection—an incomplete skeleton having skull, jaws, limb bones, vertebrae and ribs, disassociated and imbedded in flint-hard sandstone. Only limited surfaces of the bones could be seen as excavated, but as near as one could judge in the field, it is undoubtedly a new type, resembling in general form the low-plateled dinosaur—but lacking dermal plates. The blocks containing these bones were quarried out and reduced as far as possible—some of them weighing four and five hundred pounds. They were then skidded down the steep hillside in old iron wash tubs retarded by ropes.

Where it required several days to excavate a specimen many miles from camp a group of men, with their beds, personal effects, provisions and water, would take the truck and camp at the site until the specimen could be brought in. Often we wished for a trailer—which would make an ideal temporary headquarters under similar conditions.

No small dinosaurs

Thus the days, weeks and months passed until we had completely exhausted the vertebrate horizon of the Mesaverde formation in this vicinity. Curiously, no bones of small reptiles were found, and only one specimen of a carnivorous dinosaur the size of a large *Gorgosaurus* and at least twelve feet high, but so poorly preserved that only a few bones were taken for identification.

As the season advanced our collection increased until we had in storage a carload of vertebrate specimens, including an enormous flora and a representative collection of invertebrates. Late in the fall our party began to disband, the men returning to college work, until only Bird, Ryan and the writer remained to finish collecting and to prospect for new fields.

During the year I corresponded with Mr. Charles G. States, who had located an enormous track in the

roof of his coal mine near Cedaredge, Colorado. This is an area in Western Colorado, also of Mesa-verde age, and known as the Grand Mesa Field. The footprint was located in the center of a room and pointed in the direction in which the room was being developed. Nearby, the coal was fourteen feet thick, but in this room the vein had been divided by a layer of sandstone estimated to be a foot in thickness, with eight feet of coal below that was being mined, and a five-foot vein above the sandstone.

In the early summer we made a trip to this mine, after the second or succeeding impression was uncovered, and formulated plans to cut down these enormous tracks with the rock between them—which would remove any doubt as to the length of the stride. The tracks measured 34 inches from the heel to the end of the middle toe and 34 inches across the side toes, showing the right and left feet in normal stride where the giant had stepped 15 feet. Compared with the skeleton of *Tyrannosaurus*, 18½ feet tall, which in life could step nine feet, these tracks indicate the mystery dinosaur to have been a beast that towered to a height of approximately 35 feet.

Giant tracks

As the second track was cleaner cut and better defined than the first, we awaited the removal of the coal that would uncover the third impression. Finally, we were informed the third track was uncovered and we proceeded to Cedaredge to add this magnificent specimen to our collection. Unfortunately in the third step the giant had stepped on hard wood, or some non-yielding substance, so that the impression was not as clean-cut as the first of the series, and we decided to take the first and second tracks of the right and left feet. On drilling through the roof it was found that the sandstone was much thicker than estimated above the second track.

It soon became evident that we had a job in keeping with the size of the tracks, for we planned to cut down a section of the sandstone roof 17 feet long by 5 feet wide and 40 inches thick, weighing approximately 30 tons. Nine experienced miners were hired for the work and assigned to eight-hour shifts so that the work proceeded without interruption night and day. Additional props were put under the block and some of the men mined out the vein of coal above and chiseled off the upper layers of sandstone, while others drilled through from below at half-inch intervals, outlining the block, while our men plastered the roof to insure the safety of the tracks. Eventually the spaces between the drill holes were cut through and the block was cut into three sections, for the original block could not pass out of the

Continued on page 235



THE LIVING DEAD

By ERICH M. SCHLAIKJER, *Brooklyn College*

Little rat-like patriarchs from the jungles of the Far East that creep before us as living images of our forefathers

THE student of evolution frequently finds the dead more interesting than the living, but most interesting of all are the "Living Dead"—living primitive animals that have changed but little since their first appearance on earth. Animals that should have died out as did their ancestors millions of years back in geologic time, but instead have managed by hook or by crook to linger on to the present.

It is customary to think of our ancestors as num-

bered among the dead and represented in our museum show-cases as so many teeth and bones collected from rocks in the far corners of the earth. But if we look around us we see many of these "ghosts" of the past in every group of living animals. Among the mammals of today, the egg-layers and the marsupials, or pouched mammals, are admirable examples for they represent the earliest stages during the first 140 million years of mammalian evolution.



PTILOCERCUS, living ancestor of man

They survive relatively unchanged in a competitive world of higher mammals, or placentals, that Nature invented 60 million years ago.

It was a momentous step in evolution when the mammals adopted a means of reproduction more satisfactory than the laying of eggs, which, although we are apt to think of it chiefly in connection with birds, was practiced by our own mammalian forebears. The great need was to produce an offspring that was more advanced at birth. The marsupial method of carrying almost lifeless offspring around in a pouch on the abdomen of the mother was a step beyond egg-laying, for it enabled the mother to incubate the eggs in her body. But the marsupials had perfected this method as far as possible, and when, after 140 million years of trial and error, mammals undertook to develop the method of reproduction that is general among them today, radical changes were necessary. A more advanced off-

spring at birth was possible only if a greater food supply could be provided during embryonic development. Under the marsupial system the growing embryo had to depend on the yolk of the egg as its source of food. But larger eggs with more yolk to hatch inside the parent was out of the question. The only alternative was to have the parent supply the nourishment. So in the more progressive mammals the marsupial technique was discarded and a new food-getting apparatus evolved. This structure is a membranous organ by which the embryo is attached to the wall of the uterus, or womb. We call it the placenta. Its walls are so thin and so closely approximated to the equally thin lining of the uterus that the blood of the foetus is able to get food from the blood of the parent by osmosis. More or less in the same way our blood absorbs oxygen, through the thin walls of our lungs, from the air we breathe.

This organ characterizes all of the higher mammals. That is why they are spoken of as the Placentals. Frequently the paleontologist is asked how it is possible to ascertain whether or not a placenta was present, when in fossil forms only the hard parts, or skeleton, is preserved. Quite naturally, this would be impossible were it not for the fact that placental mammals are distinct in many other characters—characters which are shown in the skeleton. The brain, for instance, is better developed than in the egg-layers and marsupials, and the premolar teeth (known in man as bicuspid teeth) are typically preceded by milk teeth. There are many other distinguishing features.

The higher mammals have undergone much change since their early beginning, but among them today are those who have lagged behind. Stunted in their evolutionary development, they portray in the flesh those first placentals of the past. It was from 60 to 80 million years ago that the placental mammals first appeared. And indeed they weren't much to begin with. Tiny, mouse-like creatures whose persistent food habit has earned for them the group name Insectivora, or insect-eaters. Not only were they the first of the higher mammals, but they are still with us today, and going strong. No other group of mammals is so inconspicuous, yet so singularly important. Insectivores have always been,



WORLD'S SMALLEST MAMMAL

Smaller than an elephant's toe nail, this Tom Thumb of the underworld, Crocidura, is a nocturnal, snooping little desert-dweller. He represents the inconspicuous and relatively small insectivores from which developed all the higher mammals, the elephant included. (Drawing by G. Frederick Mason)

ERICH MAREN SCHLAIKER, the author of this article, is already known to readers of NATURAL HISTORY through his "Living Prehistoric Animals," published in February, 1937. He was born in 1905 at Newtown, Ohio, and passed the years from the age of four to nineteen on a ranch in South Dakota. He

was graduated from Harvard University in 1928 and received his Ph. D. from Columbia in 1935. Doctor Schlaikjer has engaged in ten summer expeditions for Harvard University to the Great Plains region and has published fifteen scientific papers. In 1936 he conducted an American Museum expedition to Alaska and in 1937 was

with Dr. Barnum Brown on the expedition referred to elsewhere in this issue. His engaging popular interpretation of earth history and evolution is an outgrowth of serious scientific research and the teaching of Paleontology and Geology at Brooklyn College since 1932.—THE EDITOR.

MAN'S LIVING ANCESTOR

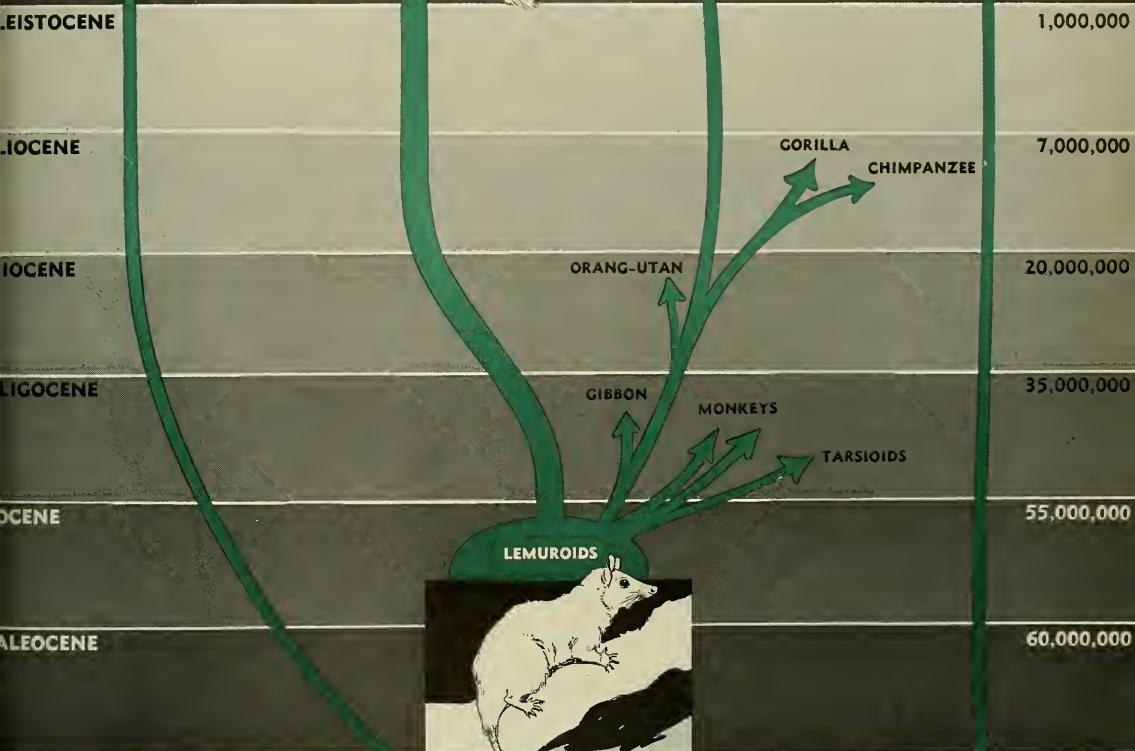
Showing our close relationship to a rat-like patriarch living today

OLD RIVER WEASEL (*Potamogale*), one of the living dead, representing the "grandfather" of our rat-like ancestor and of all higher mammals

FEATHER-TAIL (*Ptilocercus*), from the Far East Jungles, the living image of our rat-like ancestor of 60 million years ago

MAN (*Homo*), the present climax of evolution, who learns from Feather-tail what he looked like 60 million years ago

THE HORSE (*Equus*), like many other mammals, has wandered farther from his ancestors than man, though not mentally.



INSECTIVORES

The chain of primitive insect-eating mammals which links all modern mammals in a common ancestry. These tiny crea-

INSECTIVORES

position because they possess all characters necessary for giving rise to the higher forms and have not been side-tracked by

INSECTIVORES

INSECTIVORES



OLD RIVER WEASEL

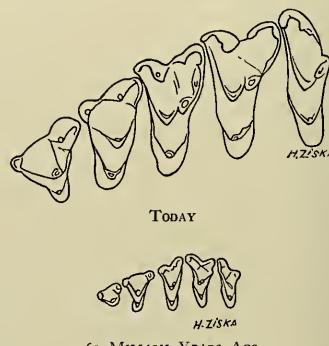
Potamogale is a living representative of the first of the higher mammals. His face is a modified fish trap and his tail is flattened for swimming, but otherwise he is a ghost from the distant past when our ancestors were insect-eaters

and are today, small animals. In their ranks is to be found the smallest mammal on earth—the musk-shrew of Africa, *Crocidura* (from two Greek words meaning, *tail like a piece of wool*). An Egyptian species is no bigger than one's thumb—a nocturnal, snooping, grubbing little desert-dweller, a Tom Thumb of the underworld. As for their importance, the insectivores top the list, or rather, they "bottom the list" for they are, or their first members were, the direct ancestors of all the placentals, or higher mammals.

It would be a peculiar world if these ancestral placentals—these insectivores—had never appeared. There would be no bears, cats, dogs, weasels, skunks; no rats, mice, squirrels, rabbits; no bats; no mammals of the seas; no hooved mammals; no lemurs, monkeys, apes; man himself would never have appeared—there may be a little consolation in that thought—and, of course, there would be no insectivores. Likewise, there are a number of less familiar mammals that would be absent. Without all these, however, there probably would still be plenty of mammals, and perhaps they would be almost as diversified.

Proof of this is shown by two groups of mammals that were present, and probably abundant, in the later Cretaceous, which have existed down to the present time. These are the egg-layers and the

pouched, or marsupial, mammals.* Isolated in Australia from the rest of the mammal world when that island continent severed connection with Asia,



Like false teeth from the beginning of the Age of Mammals, Potamogale's present-day dentition is an enlarged duplication of that of one of the earliest insectivores, Palaeoryctes (Drawn to scale 4 times natural size)

*See "Living Prehistoric Animals," by Erich Schlaikjer, *NATURAL HISTORY*, February, 1937.

these two very primitive groups have done a grand job of surviving. The marsupials in that continent, and to a certain degree in South America in the late geological past, went through a great adaptive radiation that resulted in their mimicking many of the higher mammals. So a look at Australia gives us a miniature of what the rest of the mammal world might have been.

But the placentals are here—millions of us—and the insectivores are the cause of it all.

So it is with particular interest that we view the past and present of these first higher mammals. Their earliest known members were found a few years ago in the upper Cretaceous beds of Mongolia by the American Museum Asiatic Expeditions, under the direction of Dr. Roy Chapman Andrews. The half-dozen specimens discovered show that these tiny cockroach-eating, dinosaur-egg-sucking creatures were ideal forerunners of all the placentals. Also, they, and their descendants known from later strata, show the antiquity and relationship of most of the living forms, nearly all of which are quite specialized in one way or another. With a few exceptions, the insectivores, therefore, are splendid representatives of living prehistoric animals as a group rather than as individuals. Nevertheless, in spite of their specializations, many forms are extraordinarily primitive in certain characters, and in this respect are living fossils.

A good example is to be seen in the otter-shrew of west and east central Africa—an up-to-date, yet ancient, insectivore, whose name is *Potamogale* (Greek for "river weasel"). He is about the size of a muskrat, with a rather cylindrical body, short legs, no collar-bones, and with a long laterally flattened tail that looks as though it has been run through a clothes wringer. Old "River Weasel" lives almost exclusively on fish, so his specializations for swimming are quite apparent. One look inside his mouth, however, and it is a different story. Of course, his face is pulled out and his front teeth are pointed and pincer-like, but these are just more fish-catching features. His back teeth are the unusual. They seem artificial for an animal with so many specializations. They seem to be but false teeth from the Cretaceous—almost duplicates of the cheek teeth worn by his forefathers 60 million years ago in the latest Mesozoic times.

More familiar members of the insectivore clan are the moles, shrews, and hedgehogs. And of these, the moles are best known, but this is probably only because the garden variety digs up our golf courses. Again, these represent primitive, although somewhat specialized, lines of insectivore evolution. But most primitive of the trio is the hedgehog. He

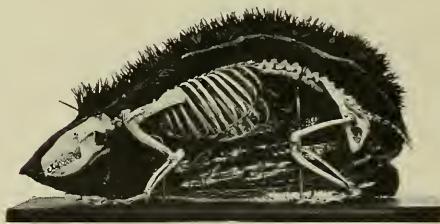
looks like a walking prickly pear since his sides and back are covered with a dense coat of short needle-like spines. These, together with his short legs and neck, and pig-like snout, are responsible for his name. He is also known scientifically as *Erinaceus*, which is Latin for the same thing. This little animal is less than a foot in length, of which an inch and a half is tail. At the least provocation, he rolls himself up in a ball and is then more of a mouthful than a carnivorous adversary bargains for. This spiny overcoat of the hedgehog is indeed a marked specialization, but it is only a superficial cloak under which is concealed an ancient animal of bygone middle Tertiary days 30 million years ago, when the hedgehog had a nearly world-wide distribution and was then an up-to-date animal.

Today hedgehogs scurry about over the greater portion of Europe and parts of Asia and Africa. They are chiefly nocturnal animals that just sleep all winter long, and are almost perpetual eating-machines during the summer months. They have a varied diet of rats, mice, lizards, snakes, birds' eggs, snails, slugs (anaemic looking land snails), worms, insects, roots and fruits. But of all these delicacies, cockroaches are the *pièce de résistance* on the hedgehog's menu. So fond is he of cockroaches that he is sometimes used to rid houses of these pests.

Everyone loves dogs. But how much more prac-



An antiquated creature in an up-to-date coat: the hedgehog, whose prickly hedge conceals a skeletal model which evolution designed 30 million years ago



AMNH Photos

tical it would be for dog-owning apartment-dwellers in New York and other great cities throughout the country, where man and the cockroach are commensal, to have hedgehogs for pets instead of dogs! The hedgehogs would eat up the cockroaches, the streets would be cleaner; and, most gratifying of all—to the nerves at least—there would be no barking and howling when the owners went out for the evening, because *Erinaceus* never utters more of a sound than a cross between a low grunt and a tiny squeak. I suppose the chief objection would be that they could hardly take the place of lap dogs.

These little bug-eaters should hold for us a particular interest, for we owe to them a great prehistoric debt. Looking back 60 million years or so into the depths of the Paleocene, or perhaps even upper Cretaceous, we find our direct ancestry among their early members, for it was then that these ancient placentals gave rise to the Primates (from Latin meaning "of the first rank"), an order of mammals which includes ourselves and our close relatives, the lemuroids, tarsioids, monkeys, and apes. We cannot be sure about the place of origin, or Garden of Eden as it were, of the primates. It may have been in Europe, it may have been in Asia—both places have produced fossil primates from early Tertiary strata, or it may even have been right here in the Rocky Mountain States of North America, for the earliest known forms have been found in the rocks of that region. Monkeys in Montana! How incongruous that would sound to the local cow-punching Westerner.

Originating as lowly insectivorous forms, the Pri-

mates have become diversified into a large number of specialized lines, and have dispersed into the far corners of the earth. Lemuroids are living today in Africa, Madagascar, Asia, and East Indies. Tarsioids survive in East Indies. Monkeys are found in Central and South America, Asia, Africa, and Gibraltar (there are, then, monkeys in Europe—if not right in Spain awfully close to it!). And the apes are confined to Africa and Asia. All had a much greater distribution in the past. As for man, he's everywhere.

In many features, especially in their highly developed intellectual capacity, the Primates rank above all other mammals; and within the order itself, man rates the top and is in many respects the most specialized of all. What could be more specialized—but used so regrettably little—than man's brain?

Although we occupy this so-called "supreme" position among the mammals, we should not lose sight of the fact that in many characters we really are very primitive. For instance, the type of hand we possess, with its four fingers and opposable thumb, was adopted long ago in Cretaceous times by our ancestor, the opossum. The grasping type of hand was also of great service to the early Primates as they swung from branch to branch in the Eocene forests. And when our more immediate forerunners were driven out of the forests and became plains-dwellers, they certainly found that the ability to grab things—stick, stone, or club—was of prime importance. Their very existence depended on this. So, down through ages of grabbing, man, by the

With brownish coat and bushy tail, Tupaia looks like a squirrel but isn't. He eats like an insectivore but has recently been graduated from their ranks. He is really a primate, and as such illustrates the transition which gave birth to the animals most closely related to man



*Courtesy E. Banks and
J. of Malayan Branch
of Royal Asiatic Soc.*

use of his primitive hands, has carved out for himself his lordly position in the natural world. Yes, in the unnatural world too, for the hand in friendly clasp is even one of man's greatest political attributes!—Man is still somewhat of an opossum.

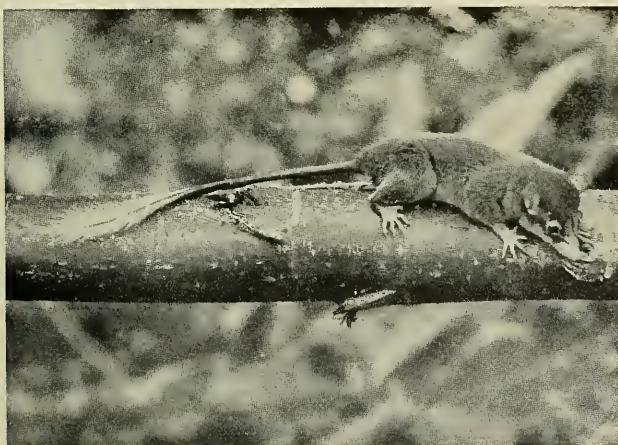
As shown above, the insectivores in one way or another are all living prehistoric animals, and in this sense, the whole group belongs to the "Living Dead." Likewise there are some of the Primates who fall into this category, and strange as it may sound, among our own present close relatives there are just such ghosts of the past. They are the most primitive of all Primates—little surreptitious, rodent-like creatures that have managed to survive almost unchanged since the beginning of the Age of Mammals. There are only two of them left, and of the living Primates they seem closest to the lemurs. And incidentally, it is only in the last few years that they have been promoted—promoted from the rank of Insectivore to that of Primate! For up to very recently the specialists, while recognizing the many Primate-like characters of these ultra-conservatives, never seemed to be able to quite make up their minds whether they were orthodox insectivores or belonged to our own order. Finally, however, the bars have been let down and these two squirrelish jungle-dwellers are now rated as belonging to the order of Primates in good standing.

It has always seemed impressively evident to me that one of the best proofs of evolution is displayed in the inability of scientists to agree on whether certain animals belong in one group or another. A few years ago came the announcement that Danish

scientists had discovered, in the Devonian rocks of eastern Greenland something like 330 million years ago, the remains of "fishes that walked." Detailed investigation, however, soon revealed that these rare and important forms were really amphibians that were still almost fishes—clinching even more thoroughly than before the argument that the higher vertebrate animals came directly from a particular kind of lobe-finned fish. There are certain fossil skeletons from the red beds of Texas that are so equally intermediate between amphibians and reptiles that the fossil experts cannot decide as to which class they belong. Then there are the two famous almost microscopic jaws from a 200-million-year-old North Carolina coal seam that for over 20 years were described, figured and refigured as dawn-mammals. Finally it has been shown that they are mammal-like reptiles—almost but not quite mammals. There are many such examples. Mistaken identity among fossils is not uncommon with paleontologists.

The animal kingdom may be searched far and wide, but of all its millions of members, perhaps none could be of greater interest to us than the two squirrel-like creatures of the Far East jungles mentioned above. In these "living dead" is portrayed the most primitive stage in all Primate evolution. They creep before us as living images of our earliest ancestors back at the beginning of the Tertiary when we were still fifty percent insectivore.

One of these so-called tupaoids is known by the scientific name *Tupaia* (from the Malayan word for squirrel). It is the more common of the two and



Little Chief Feathertail, Ptilocercus, is the rarest, least known, and most primitive primate. At the foot of the ladder leading up through monkeys and apes to man, this first ancestor of ours, however reluctant we may be to admit it, looks much like a rat

Courtesy E. Banks and J. of Malayan Branch of Royal Asiatic Soc.

the various species are distributed over India, Burma, the Malay Peninsula, the Nicobar Islands, Sumatra, Java, Borneo, and the Philippines. In its general appearance and size *Tupaia*, or Tupy for short, is very much like the ordinary squirrel. This is especially well shown by his brownish coat of fur and long bushy tail. Even in many of his habits Tupy has mimicked the squirrel, but that is about as far as it goes. His face gives him away. The whole muzzle of his head is a sort of drawn out, pointed affair—insectivore-like more than anything else. And so it is with a lot of the rest of him. On close inspection, the skeleton and soft anatomy of this archaic little Primate show that embodied in him is a whole array of features that tie in with the insectivores, yet he possesses even a greater number that rank him with the Primates. So the status of Tupy in the animal world may be summarized as follows: He is a somewhat specialized, yet an extraordinarily primitive Insectivore-Primate. A form which has progressed considerably toward those lowly Primates the Lemurs, although one which has kept a marked insectivore make-up. With this combination of characters, Tupy represents a group of mammals that flourished over 60 million years ago—a group that was transitional between those cockroach-eating creatures that are still represented today, and the most advanced of all mammals, the Primates—ourselves included.

Portraying even better the transition between the insectivores and the Primates, is the only other living representative of the first of our immediate ancestors—the little rat-like, pen-tailed tree-shrew of Borneo, Sumatra, and the Malay Peninsula. The scientific title of this elusive little living fossil is *Ptilocercus*, which means “feather tail” in Greek. He is so named because the far end of his naked and scaly tail is ornamented with a feather-like arrangement of white hairs.

Little Chief Feather-Tail, as I choose to call him, is the rarest and perhaps the least known of all the Primates. The first specimen made known to science was captured in the Rajah's house at Sarawak, Borneo, was sent back to London, and described in 1848. This was 90 years ago, and only very recently has the skeleton and soft anatomy of this most primitive living Primate been thoroughly studied. There is a great deal concerning its natural habits that is still unknown to us.

Some people will hate to admit it, but this living image of our first Tertiary ancestor looks much like a rat. He is a little less than a half-foot in body length, and his scaly, almost hairless tail is a couple of inches longer than that. When curled up in slumber the tuft of hair at the end of his long tail

is used as a sort of covering for his extended nose—perhaps functioning as a kind of mosquito chaser. His hair is soft, fairly short, and is grayish-brown in color. His head is proportionately large, and his face, beset with cat-like whiskers, is rather pointed, although less so than that of *Tupaia*.

Little Chief Feather-Tail is strictly a night prowler. His rather large inquisitive eyes are in keeping with this habit. Throughout the daytime he confines himself to a nest of leaves and fibre in a hollow of some tree. This probably accounts for the fact that he is so rarely seen. Tree dwelling is an old custom in the tribe of Little Chief Feather-Tail, being the habit of his first ancestor at the close of the Cretaceous some 60 million years ago, and many tree-climbing characters have been passed on, relatively unchanged, from father to son during this time. The spreading little feet of our Little Chief with their primitively arranged soft pads, their pronouncedly diverged thumb and great toe, and their long curved claws serve as admirable evidence of this. Occasionally this ancient little animal comes down to earth out of the ancestral tree-top home, and manages to get along pretty well by a sort of hopping locomotion. Only in the trees, however, is he definitely at home.

The same diet for 60 million years! Insects and more insects—so it has been in the Feather-Tail family, and so it is with the Little Chief. He is, however, partially omnivorous for, in captivity, his favorite diet seems to be the unsavory combination of cockroaches and bananas.

Throughout the soft anatomy—tongue, stomach, liver, intestines, muscles, brain, et cetera—of this little fellow are tens of outstanding primitive characters which show a transition from the insectivores to the higher Primates. Nevertheless all these represent a stage a little closer to the Cretaceous insectivores than do those of *Tupaia*.

Likewise, the flesh of this reticent living forerunner of ours is supported by a skeletal framework that is equally ancient. The skull and dentition display at least a dozen outstanding primitive characters, while not a single marked specialization is revealed. There are about a dozen striking features of the skull and teeth that show progress toward the Lemurs. In these parts of the skeleton, Feather-Tail seems slightly closer to the higher-ups among the Primates than does *Tupaia*, but the reverse is true for the rest of the skeleton. Considered in his entirety, the Little Chief is a more generalized and a more primitive Primate. *Tupaia* has already wandered some little distance from the Insectivore-Primate boundary line—*Ptilocercus* is still almost on the fence.

The "paleogenealogist" would picture *Tupaia* as crouching on a short limb near the base of our faintly tree, whereas he would consider *Ptilocercus* as nestled in a knot-hole in the very trunk. The roots of that tree run down deeply into the geological past where the earliest Placentals are burrowed into them. In the moss at the base of the trunk a handful of those ancient ancestors of ours are still sniffing out the cockroaches. That tree is not as healthy as one would expect. To be sure it is not lacking on branches—it is almost top-heavy. But many of those branches are leafless and dry. They represent the numerous forms that already have become extinct. Some of the living branches are rather withered and scraggly. Swinging from some of the greenest are the lemurs and monkeys, and squatting on the very top-most branches are the higher apes. As for man, we may picture him as standing on the ground on the shady side of this his ancestral tree—the ripest fruit that ever fell from it. Before him are the fields of the future. And he might be reminded that he is not alone, for in that pasture there is also the proverbial bull of Nature. Man had better watch his step.

If we turn back the pages of the last 60 million years of earth history, we discover a very different sort of world. For 140 million years previous to that time the dinosaurs and hordes of other land-living reptiles had had their own way. Proudly they stalked over the earth's surface and completely ruled the animal kingdom. But by the close of this reign of terror—this "Age of Reptiles"—nearly all of those gangster dictators had entered into one of Nature's most gaping pit-falls—over specialization. So satisfied did they seem in their radical evolutionary changes that for them there were no lessons of the past, and their immediate Mesozoic environment seemed to prophesy an endless future.

Then came the dawn of the Cenozoic. A great revolution was under way. Mountains appeared where there had been great lowland area, and what were once extensive inland seas and marshy land became plains and arid country. As is always the case with any group of animals under such trying conditions, the reptiles were confronted with three possibilities—migration to more favorable environments, readaptation, or extinction. As for migration to more favorable environments, that, of course, was done. But this revolution was world-wide and it built up barriers that were extremely great. Migration for the reptiles only meant prolonging the end for a short while. The possibility of readaptation was out of the question in 80 percent of the cases because of over-specialization.

The answer then for nearly all the reptiles was extinction. Only a mere handful survived. They could not overcome the obstacles of a world-wide revolution, nor could they compete with the many new advanced vertebrate forms that were able to conquer the new world. Those radicals, those dictators, who had so thoroughly dominated the animal world for so many millions of years were defeated.

Throughout this struggle the early mammals had eked out an existence at the feet of these monsters, but in their own ranks there were also many that had gone off on radical tangents of over-specialization. They, too, became extinct. Likewise, there were those ultra-conservative forms that were easily defeated. A few lived on and today a couple still survive.

More significant among the mammals, however, were the first placentals who made their appearance toward the close of the Cretaceous. They were conservative, yet progressive, in their evolutionary changes, and when the Mesozoic conflict was ended, these Conservative Liberals were in control. These earliest Placentals—these Insectivores—were destined to give rise to all the higher mammals. The world was theirs and they began to flourish. But invested with such complete control, it wasn't long before they began to fight among themselves, and many new factions arose. So for the last 60 millions of years all has been struggle in mammalian evolution. Each geological period has had its three main factions in every group of mammals, but each time it has been extinction for the Radicals and Dictators, survival for a few Ultra-Conservative living fossils and victory for the Conservative-Liberals.

The Insectivores were advanced mammals for their day, although they were then, and still are, very generalized mammals. As we have seen, one of the earliest factions to break away from these most archaic placentals were the Primates. And the Primates stand out in striking contrast to their primitive ancestors, for they have become the most advanced of all placentals. But in spite of their progressive evolution there has been much diversity among them, and today it is not difficult to distinguish the Radicals, the Conservative-Liberals, and the Ultra-Conservatives or Living Fossils. *Tupaia* and *Ptilocercus* are preëminent among the latter. But slightly changed throughout 60 millions of years, they are living images of our first Insectivore-Primate ancestors. Out of the past these "ghosts" have come as if to show us what we once were like—among our immediate relatives these are the living dead.



MAPLE SUGAR TIME



AMNH Photo by Bierwert
SINCE before the coming of the white man to North America, early spring has been a time when the groves of maple grow fragrant with the aroma of boiling maple sap. Not only did the red man discover how to make maple sugar but he is described in early records as mixing popcorn with maple syrup, thus creating the confection that is generally associated only with present-day ball games and amusement parks.

The model at the top of the page was built under the direction of Dr. Clark Wissler of the American Museum to show a typical Indian sugar camp of about 1492. Little change has since occurred in the basic methods. The dome-shaped, bark-covered hut protected the utensils when not in use. Men and women took part in the work. With a stone ax a simple gash was cut in the tree as shown at left, usually on the sunward side. The spout was a shallow trough-like section of wood inserted below the gash, which directed the dripping sap into a bark vessel beneath

AMNH Photo by Coles



AFTER BEING COLLECTED from the separate trees, the sap was boiled twice in bark kettles and poured while still warm either into small wooden moulds or into a canoe-shaped wooden trough where it was pounded until granulated

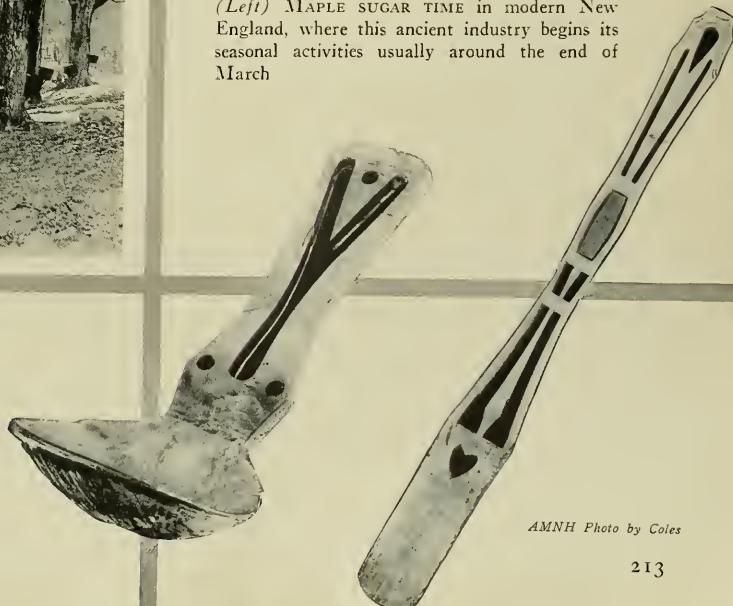


Courtesy, Lippincott, Grambo & Co., Philadelphia



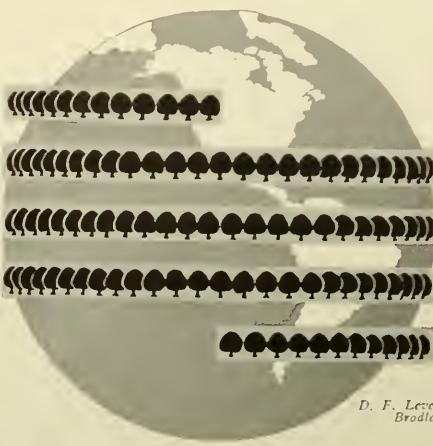
Brown Bros.

(Right) A STIRRING STICK and ladle used by the Indians in the making of maple sugar



AMNH Photo by Coles

(Left) AN OLD ENGRAVING showing the maple sugar industry in its primitive infancy. Twenty million maple trees were tapped in the United States and Canada in 1935, which if placed in a row 26 feet apart would encircle the world four times. Six million dollars are estimated to be derived annually from the industry in Canada alone



D. F. Legett
Bradley

(Left) EARLY SPRING in the North woods: a print published by Currier and Ives, depicting the adoption of the Indians' technique of extracting sugar from the maple forest. The sap often starts to rise before the snow is off the ground, and sledges are characteristically used for transportation over the soggy ground. Snowshoes, an Indian invention, are sometimes worn by the men; and horses, oxen, and even dogs, are used today to draw the loads

(Left) MAPLE SUGAR TIME in modern New England, where this ancient industry begins its seasonal activities usually around the end of March

THE STORY OF SPICES—*Their fragrant trail through history is stained with crimson and glitters with ill-gotten gold, but it led to some of the world's greatest discoveries and to unparalleled cultural progress*

By VIRGINIA S. EIFERT

With drawings by the author

SPICES may now be innocent adjuncts to egg-nogs and rice puddings, but in their hey-day they were a will-o'-the-wisp that sent men out to adventure and discovery. Spices were a direct incentive to empire building; wherever they laid their golden touch, nations and cities blossomed under that magic influence. Great churches and palaces were built; the arts flourished; men lived without laboring. Spices beckoned and men followed. New worlds were discovered, new oceans were explored, new standards of living were raised. Spices led the world out of the Middle Ages and set the door ajar for modern business and invention. . . . And all this lies in a few cannisters of cinnamon, nutmeg, ginger, and pepper standing on the kitchen shelf.

Although no one knows who was the first to discover it, the gift of spice came as a blessing, not only to the merchant princes but to the common man. With only a monotonous round of meat and bread, dried beans, peas, and lentils, fish, fowl, and pot herbs, and a few local fruits in season, the diet of ancient times was made into a feast when pepper was discovered. Cinnamon was sprinkled in bread-dough to make it a cake; ginger made the inner man glow with pleasant warmth. Spices not only helped to preserve certain foods past their season, but also figured largely in the medicines of early days. Spices were a blessing which captured the world as soon as the slow-plodding camels brought these new flavors to the crowded market-places of Athens, Rome, and Damascus. Nature was kind when she gave condiments to a harsh world.

The first known spices were cassia, ginger, and pepper, all of which grew in China; later there were a few cloves, some anise, and coriander grown in India. Across India these spices came by a long and dangerous caravan journey to Greece and Rome. Roman noblemen paid large sums for an ounce of cloves; Grecian princes gave seven sheep for half a pound of pepper; and ginger, called Zingiber, was subject to exorbitant taxation at Alexandria.

The history of Chinese cinnamon, or Saigon cassia, goes back to 2700 B.C. It was the first spice to be sought after in Oriental travels. In western

Asia the ancient Jews used oils scented with cinnamon for anointing the sacred vessels of the Tabernacle.

Coriander was known as early as 5000 B.C. and for many a century it was called a cure for epilepsy, the spice being suspended above the patient's pillow.

Although their source was known by only a few people, cloves had been brought from distant islands and planted on certain Chinese islands and in India. By the third century before the birth of Christ, the Chinese were using cloves for perfuming the breath, and in ancient Persia cloves were used for creating love in potions and aphrodisiacs to excite the senses to passion.

Anise was mentioned by Pythagoras, and garlic, one of the most ancient of condiments, was eaten by laborers who built the Egyptian pyramids. Accounts listing so much garlic per capita as food for the workmen are to be read on clay tablets in museums. Garlic was consumed in great quantities by the laboring classes of Egypt, Rome, Greece, and Asia Minor, but the upper classes never touched it, considering that a man was vulgar to smell of garlic. In China and Arabia it was worn as a charm to ward off the evil eye.

For centuries spices came by camel-caravan across China and India, up the Persian Gulf by sailing vessel, and by camel-back again across the desert to Aleppo. From here spices were sold to merchants who peddled them up and down the Mediterranean. Arab merchants secretly obtained condiments direct from the Orient, and in the ninth century after Christ, these Arabs brought spices for the first time to the market-places of Europe.

To a people whose narrow lives were bounded by their own villages, these new flavors came from a dim, half mythical place known as Araby. The swarthy Arab merchants fostered this vagueness by telling terrible tales of monsters in the sea and men-like demons on land who guarded the trees so that none but the bravest of adventurers could obtain spices. And the merchants in town, with these tales of horrible difficulty and defiance of danger to build upon, were able to boost the price of spices still higher. And the higher the prices went, the greater in demand were the fragrant little grains from a far-off source. They soon

wrought a splendid change upon people living in the ugly, half primitive environment of the Middle Ages. Only the very rich could afford them, so spices came to signify wealth. Even the poor, not to be outdone without a fight, went without necessities in order to carry on a show of using condiments.

noblemen ordered murals and frescoes to be painted by Raphael, Michaelangelo, Titian, or Da Vinci. Every man of wealth sat for his portrait by the artist who was in fashion at the moment. Princes gave paintings and statues to the new churches which were being built with spice money. The spice trade had begun its procession across the continent



The Venetian sailors were the first to start the trade in earnest. They made a business of meeting caravans out of the Orient and of selling spices at exorbitant prices in Italy, Alexandria, Beirut, Constantinople, Athens, and Damascus. Venice ruled the shipping on the Mediterranean, and from the wealth accumulated from spices and silks, the architectural glories of Venice in the Middle Ages began to rise. The great painters and sculptors became known for their masterpieces, for under the kindly warmth of spice profits, artists no longer starved unappreciated. Wealthy merchants and

of Europe, and Italy was the first to feel the luxury it brought.

There was a reason for this great demand for spices. A mere pleasant taste could not have sent empires rushing to share in the wealth brought by the sale of condiments. Spices had become a necessity. Food, aside from being decidedly monotonous, was usually so bad-tasting that it was inedible without some strong, hot flavor to disguise it. Pepper, cloves, cinnamon, and nutmeg, therefore, were blessings whose very rarity and costliness made them the more to be desired. The rich would pay any

price; the poor hoarded the few small grains they could purchase. It was no wonder that the trade was such a profitable one.

Various medicinal properties, besides, were rightly or wrongly assigned to spices. Garlic was used as a remedy for leprosy. Angelica had power to ward off diseases and evils of witchcraft. Clove oil stimulated digestion, checked vomiting and excessive coughing, and killed pain in the teeth. The smoke of burning coriander seed induced hallucinations, and was part of the stock-in-trade of most magicians and witches. Nutmeg was used as a fumigant in the streets of Rome, and nutmeg tea was a cure for insomnia. But poisoning from an over-use of nutmeg probably often resulted from the highly toxic myristicin, four percent of which is contained in the nutmeg seed.

Wrinkled old alchemists, peering through the acrid smoke of their dark laboratories, explained that spices had souls, and he who obtained those souls obtained the full potency of their magic. Only the alchemists knew that spices were potent in fancied ways about which the people never dreamed.

Europe was in this state of mind when Marco Polo came back from an utterly incredible trip to the Orient. On his return, to while away his time while serving a prison sentence, he wrote a book, with a fellow-convict as his amanuensis. In it he told of actually seeing cassia, ginger, and camphor growing in China; of seeing cloves and nutmeg in Malacca; cinnamon in Ceylon, and pepper on the Malabar coast of India. Polo's book was eagerly devoured by those who could read. Many who were navigators or merchants read it earnestly and they began to think keenly on a subject which had never entered their minds before. If one could but find an all-sea route to India and so obviate the difficulties of deserts, caravans, bandits, starvation, and death in strange lands, he might make a fortune by sailing off to India to get a load of spices. It was something serious to be thought upon.

The Venetians, however, seemed satisfied with the Mediterranean, whose boundaries, though narrow, were safe and well inhabited. Sailors were certain that no sea monsters lurked in the pleasant blue depths of the Mediterranean, but out in the oceans beyond—who knew what lay in wait for rash adventurers?

In Genoa a boy grew up with Marco Polo's book as his guide and Bible. When he became a man with the idea of sailing westward to reach India, he found it difficult to get support. At last the young man, known in his home town as Cristoforo Colombo, obtained the assistance of the King and Queen of Spain. They outfitted him with a crew of convicts and a trio of leaky vessels from a cast-off navy;

they sent him westward with pleasant words and extreme doubts of ever seeing crew or money again. They had, however, many anticipations as to what they would do when—or if—there was a return with news of a short-cut to India. Once in India, the Spanish would win eternal wealth and glory, for India meant spices, and spices meant wealth.

Columbus sailed westward—everyone knows his story—and found a land which was later claimed by the Spaniards. The new land was not India. There were no spices—at least he found none. He did not know about allspice and vanilla and cocoa, which would be discovered later when the Spanish occupied the West Indies and Mexico. He found nothing of any consequence and was jailed when he returned without having found a westward route to the sources of spice.

It was only a few years after Columbus' first voyage that Da Gama reached India by sailing around Africa. In conflict with the Mohammedan traders he established mercantile relations with the native ruler of the Malabar coast of India and returned with a store of spices and other valuables. At last Portugal had a trade route with the East.

About this time in history, the price of pepper had risen too high for anyone but speculators and noblemen to buy it. The tax alone in England amounted to \$1.25 per pound. When Da Gama returned loaded with spices and pepper, Portugal forthwith set about to keep the price of pepper as near the old caravan figures as possible.

Not long after Da Gama's voyage other Portuguese sailors ventured into the waters east of India, went into the Sunda Straits, passed Java, and discovered a group of islands which no one had ever known—no one, perhaps, but the Arab merchants who had long kept their secret.

Trade in pepper is one of the oldest in the world; pepper is still the most valuable spice to be had. For a long time its roots were thought to be the source of ginger, for both had the same pleasant fire to the tongue. Pepper was a staple article of trade between Europe and India from the very beginning of spice commerce. It was so expensive that it often replaced money in business transactions. Tribute was sometimes levied in pepper: when Alaric the Goth besieged Rome, the ransom he demanded included three thousand pounds of pepper.

With the growth of the spice trade, every great nation sought to gain a complete monopoly, and it was because of this competition that most of the blood was shed over these fragrant plants. When the Portuguese, with the right of priority which Da Gama's discoveries gave them, took up residence in India and elsewhere, the other strong countries

of the world cast jealous eyes on them, and vowed that the Portuguese should not monopolize the spice trade.

In India, Portugal's main stronghold was at Goa, and here the Portuguese East India Company was organized for the purpose of exploiting the sale of spice and of keeping intruders out. During the six-



teenth century the bulk of the spice trade fell to Portugal, and it was at this time that the finest buildings in its history were erected. However, Portuguese rule in India was cruel and inhuman. Religious fanaticism came forward, and in the name of spice and the Almighty, the Portuguese went to the extremes of inhumanity during the horrible Inquisition at Goa.

The English were the first definitely to develop the idea of reaching the East by an Arctic route, and in 1552 three vessels left on an ambitious but ill-fated attempt to sail over the top of Norway

and Siberia. These efforts were hopeless with the equipment and knowledge of the period. It was the Dutch who in the failure of a northern route first successfully competed for the trade by following the Portuguese around Africa. The Spice Islands, known as the Moluccas, which they captured, are a group of half-submerged mountains surrounded by the Philippines on the north, New Guinea on the south, Java and Borneo on the west, and the South Sea Islands on the east. The tops of these half-drowned mountain peaks were covered with a thick forest growth in which spice trees flourished. The islands were unimportant for anything but spice, but this alone was sufficient to put the Moluccas on every map of the world.

The spice trade had long since left the hands of the story-telling Arab merchants and now fell into the greedy hands of the Portuguese, Dutch, and English traders. Discovery, ships, pirates, death, jungles, and Malay natives became the dream of small boys and the realization of older ones. Spice —those little seeds, buds, and roots of concentrated flavor—woke the civilized world from its medieval lethargy and brought about the discovery of the East and West Indies, the Americas, the Orient, and the Philippines. The Portuguese had opened the way, but it was the Dutch whose energy smashed barriers, hurdled obstacles, and brought to its highest peak the highly competitive East India trade.

In 1600 Queen Elizabeth organized the British East India Company to combat Portuguese trade, and the Portuguese at the same time were finding their hands full with the Dutch, and finally were conquered by them. The British came in, but the Dutch, after several ferocious attacks and bloody massacres of the English on the islands, became the rulers of the East Indies. Their rule during the entire century was no less cruel and inhuman than that of the Portuguese. Lust for spice engendered incomparable brutality in men as they fought for the wealth it brought.

The Dutch took over Amboina, a large island in the group of the same name off the coast of New Guinea in the Banda Sea. Here they calmly murdered the Portuguese traders and made the island a base of operations from which they could obtain the rest of the Moluccas. In the meantime, Amboina was discovered to contain what was probably the largest clove plantation in all the Indies. This was especially providential because at that time in Europe, cloves brought tremendous prices. It will be recalled that the cloves which one of Magellan's ships brought back were sold for more than the cost of the entire three-year expedition. In Europe at one time a pound

of cloves was worth the price of seven sheep. Cloves on Amboina would make the Dutch all rich men, and in addition to the little fragrant "nails" there were extensive groves of nutmeg, as well as some cinnamon, cassia, and pepper. The spices of Amboina, Ternate, and Banda would make all of Holland wealthy. The Dutch thereupon planned to force a monopoly and soon own all the spice to be sold.

There happened to be cloves on other islands—cloves, nutmegs, and pepper—so the Dutch went out at night in long, slender Malay praus and set fire to the spice trees on the other islands in the Banda Sea. The nights were made bright with leaping flames as the praus crept close to the plantations, dark figures slipping ashore to send the precious trees blazing skyward. The Dutch, because they could not guard all the islands at once, burned the trees so that no one else could profit by the sale of spice.

But when the Dutch destroyed most of the clove and nutmeg trees on the Portuguese islands, they did not reckon with an all-generous Nature, which

raged for many years, were so named from the Spanish "clavo," meaning nail. They grew on small, rounded, evergreen-leaved trees of the Myrtle family. Leaves, buds, and flowers all exuded such a sweet, overpowering fragrance under the tropic sun that even before land was sighted the odor could be smelled.

It was the natives, as much as or more than the Portuguese, who objected to the high-handed burning of the precious groves. The East Indian native stood somewhat in awe of the clove. He planted a tree at the birth of every child and would not hear of destroying such sacred trees. When a man's birthday clove-tree was killed, it meant to the superstitious native that his own death was imminent. So there was many a native workman who betrayed a coming Dutch raid to the Portuguese, many a planter's bungalow raided and destroyed, many a poisoned arrow in a writhing Dutchman's back. Cloves were easily obtained, easily prepared for trade, but it was the warring natives, the spice pirates, the enemy countries, the hurricanes, and



CINNAMON

permitted spice to grow alike on the islands of the French, the English, and the Spanish. The muggy, tropical atmosphere, sea air, abundant moisture, and loose, sandy soil which spice trees demand are present on almost every island in the tropic seas.

The cloves about which international battles

the wilting heat which made them so costly in Europe.

Cinnamon, almost as high in value as cloves and pepper, was most abundant on the island of Ceylon. Before Ceylon gave up the secret which lay hidden fragrantly in the deeply shaded glens, there

was a similar shrub with a similar, if not so fine a flavor, known as Saigon cassia, which was grown in China and India. Cassia was one of the oldest spices, but when cinnamon itself was discovered, cassia lost a degree of its popularity. The knowledge that Ceylon had the world's finest cinnamon was a grief too great to be borne by the Dutch planters, so in 1770 they ended their gloom by stealing Ceylon. Under the stern rulership of the hard-headed Dutch planters, the Singhalese princes were compelled to bring cinnamon bark as tribute, and the cinnamon-cutters became a special caste of low-class natives from which there was neither escape nor redemption. Generation after generation of natives was born into the cinnamon-cutting caste. It was a life of harsh punishment and unremitting labor in the broiling tropic sun. These were the natives, however, who brought the cultivation of cinnamon on Ceylon to its peak.

The Dutch kept Ceylon only until the English under the British East India Company captured it in 1796. Cinnamon thereupon became a monopoly of the East India Company of England until the end of the company in 1858.

Cinnamon, the innocent cause of many a cruel death, grew on low trees and bushes in the white sand region of Ceylon and was exceedingly difficult to transplant or to cultivate. The bark of the upper shoots was peeled off in rolls thinner than paper, and was fitted together in long sticks containing hundreds of layers. It was shipped in this way to Europe. Here in the warehouses it was ground between two stones and sifted through silk. Today three-fourths of all the cinnamon used in commerce is Saigon cassia mixed with true cinnamon.

When the traders first saw them, nutmegs looked more like good European apricots than anything else. Though they were beautiful, rosy-cheeked, yellow-orange fruits, they were not quite the shape of apricots—rather too tapering at the stem-end and too blunt at the base. When the fruit split open, a large stone covered with a network of brilliant scarlet threads was revealed. The stone was the nutmeg itself; and the network of red threads, when dried and ground, became the spice called mace. At one time, because there was more demand for mace than for nutmeg in Europe, the pompous old spice merchants in the warehouses of Amsterdam leaned forward a trifle in their heavy chairs and spoke gruffly through their beards—

"Cut down half the nutmeg trees," they said, "and plant more mace." How could they know, with their fat lives bounded by the safe shores of Holland, that nutmeg and mace grew on one and the same tree!

Nutmegs were destroyed on all the islands except Amboina, where they could be watched. The hope was that no nutmeg was ever to escape the monopoly of Amboina and the Dutch, so nutmegs were guarded like precious gems. To prevent them from growing elsewhere, all nutmegs ready for shipping were kept in a lime bath for three months. They all, therefore, bore a white coating of lime water, and even today they are still whitened, not because of any monopoly, but merely because they have always been so and probably always will be.

In 1769, Governor Poivre of Mauritius, one of



the French islands, paid a friendly visit to the Governor of Amboina. No one knows exactly how the thing took place. We can imagine the Frenchman in his politest manner asking to be shown the famous nutmeg plantations. The wary Dutch Governor may have been overcome by the Frenchman's suave manners, and the two may have driven around the island to view the nutmeg trees full of beautiful fruit. When Governor Poivre left Amboina, he had both nutmeg and clove seeds hidden on his person. He took these precious contrabands to Mauritius, east of Madagascar, and patiently cultivated the trees that grew from them. In 1796, an Englishman, much in the same way, managed to steal nutmeg seeds and planted them on Penang. The Dutch suddenly discovered that their monopoly was a thing of the past. The whole world was going to have nutmegs from the French and the English—

and from the Dutch only if they stepped lively.

Natives called the nutmeg the "pala" and had many superstitions about it. One was that it must be able to hear the sea—that it would not grow unless the sound of pounding surf was heard not far away. The natives also believed that in order for the tree to bear its full crop it must have animal manure. Blood, bat guano, bird guano, dead animals, shrimp "dust," fish refuse, and stable and pig manure were buried around nutmeg trees, and even poor, non-bearing trees suddenly became healthy and prolific under this treatment.

Ginger was planted on the islands from roots brought from China. Long before Europeans had become acquainted with the wonders of spice as an embellishment to food, love, and personal adornment, the East knew and reverenced ginger. The Chinese and Hindus since very early times had used it for a flavor, a candy, and as a medicine. Sanskrit, early Chinese literature, and the Talmud all spoke of the excellent qualities of ginger-root. It was a purple-and-yellow flowered sedge, whose thick, pungent and gnarled roots were dug and scraped, and then dried or candied for commerce. Ginger was not cultivated on a large scale until the Spanish

to keep prices high in Europe, spices were something for which men sweated, fought, and died. Pirates worked the spice lanes on the seas. Malay pirates lay in wait for spice ships which, laden with scented cargo, made their way out of the Indies toward the civilized world. It was small wonder that spice, although so abundant on the islands, was so costly in Europe. There was bloodshed, danger, and disaster involved in every carton of pepper and cinnamon; in every container of cloves and nutmeg.

While turmoil raged in the East Indies, more drama was enacted in the West Indies and in Mexico, where the Spaniards, whom the English thoroughly hated, were making rare discoveries.

After the Spaniards had found vanilla and chocolate in the interior of Mexico, Elizabeth of England, though she vowed never to have anything to do with Spanish-grown, Spanish-shipped, or Spanish-bought spices, secretly longed to taste those two new flavors. Moreover, there was that new tree called the pimento growing in the West Indies—a tree whose seeds contained a flavor like cloves, nutmeg, and cinnamon combined, and were known as allspice. The Spanish discoveries in the Americas had irked Elizabeth because she thought England ought to have beaten the Spanish at the game of ship-sailing. All that her Francis Drake and her Captain Cavendish could manage was to sail around a vast unknown continent while the Spanish were going into Mexico and bringing out gold and gems and those provocative new spices. Cocoa, vanilla, allspice, and delightfully fiery peppers all grew in the New World.

Chocolate had been drunk as a beverage by the Aztecs and Mayans for centuries before Columbus came to the Americas. The early Mexicans ground up the flavorsome, fragrant, black vanilla pods with cocoa to make "chocolatl," their national drink, and this so charmed the Spanish conquerors who followed Columbus that they brought it home with them.

Vanilla was discovered by Spanish roustabouts in search of gold. They found the Mexican natives cultivating vines bearing fragrant white orchid flowers—vines in the steaming, green-shadowed jungles of tropical America. The Spanish saw dark-skinned men and women picking long beans and fermenting them to develop the delicious vanilla flavor. They saw, too, the hosts of little hummingbirds flashing among the vanilla vines, but none of the rude Spanish knew that the hummingbirds were pollinating the vanilla flowers so that there might be pods containing that rare and delectable flavor.

Instead, the Spanish slaughtered the puzzled



planted it on Jamaica in the West Indies. Jamaica ginger made a name for itself even after the Spanish, with bad grace, gave up the island to the British.

In spite of monopolies invented by men, in spite of Nature's lavishness in planting spice trees on many islands, and in spite of the burning of crops

brown people, and took a load of stolen vanilla beans back to Spain with them. Spain liked vanilla. At once its exportation from Mexico began, but the Spaniards kept such a close-fisted monopoly on all that came out of the Americas that Queen Elizabeth, for all her importance and her pride, had not the privilege of tasting either vanilla or chocolate until long after their discovery. When at last she sipped the New World brew, Elizabeth the Queen became Elizabeth the epicure.



The man who stole vanilla from Spain and brought it to the Queen of England has long since been forgotten. Elizabeth is dead, and the Americas have grown far beyond anything her fertile mind ever dreamed about. But vanilla has that distinctive and delicious flavor which will not let its popularity die. A cheap substitute for vanilla is coumarin, obtained from tonka beans in Trinidad and South America. The flavor known as vanillin is also obtained from pine wood and from oil of cloves. Still in the jungles the hummingbirds pollinate the vanilla flowers, although on the plantations the white blossoms are now pollinated by natives with pointed sticks who transfer pollen from pistil to pistil.

While all these things were going on, stark

drama was being enacted in France. It was in 1720, and the Black Plague was infecting the land. Once again spice played an important part in the history of nations. People were turning black and dying in every house as four certain thieves went about unafraid and robbed both the dead and dying. Fear of the plague had so undermined the morale of the city that the people had neither the courage nor the will to bring the infamous thieves to justice. Wherever there was a house abandoned to the Black Death, the ghoul-like four entered, plundered all that was of value, even taking crucifixes and rings from the hands of the dead, and went away in safety. When at last the four were arrested, their sentence was tempered by their revelation of the secret to which they attributed their apparent immunity. This secret, which astounded all of France, may have started the beginnings of research into antiseptics and the discoveries made by Lister and Pasteur in the next century.

The thieves had concocted a wonderful liquor which became known as the Vinegar of the Four Thieves. It was composed of cinnamon, garlic, camphor, and cloves, combined with other aromatics, vinegar, and red wine. The antiseptic quality of this vinegar was what gave the Four courage to go about robbing the dead and dying. Once more spices were important—important in the drama of life, death, and the combat of disease.

Spices even played a part in the growth of the United States. At the close of America's war with England, the American Merchant Marine came into existence. Competition with other great nations of the world whose East India companies were trade indicators and trade dictators, was a difficult thing to enter. The fast-sailing clipper ships of the rash Americans went faster and more surely than the slower, more cumbersome Dutch and English vessels, so before long the American Merchant Marine was something to be watched with anxiety. But since India and the Indies were full of Dutch, British, French, and Portuguese traders, the American navigators prudently stayed away from trouble and instead opened the China trade with Canton. Massachusetts shipowners became rich and built the white houses that still stand in Salem and Boston. They are houses built by profits from the China trade, not the least part of which was ginger for ginger-jars, and that incomparable conserve called "East Injy."

The American Merchant Marine, with its shrewd, whiskered old sea captains who fill the legends of Massachusetts today, brought back from the ports of India itself a new flavor in the reper-

tory of American foods. In the unknown land of India the people, in their lives of passive resistance, had long sold spice to traders, had permitted the low-class natives to be slaves on the spice plantations, had been persecuted and tortured in the Inquisition at Goa, and had suffered under the autocratic rule of the British East India Company. Year after year, century after century, the Indians worked and prayed in the land below the Himalayas. India produced spice, sold spice, and the rajahs grew rich on spice, but always India kept as its own the secret of curries.

The flavor of curry is not one which Occidental people can easily understand. Unlike other spices, each one of which is a single sensation in taste, curry is a subtle blending of those famous spices which have gone into the making of history. Occidentals, when they know it at all, know only one curry; in India each kind of fish and fowl has its own particular blend of curry spice.

Curries in India gave zest to commonplace rice and oftentimes unwholesome foods. One favorite curry recipe is composed of coriander seed, Madras turmeric, cinnamon, cummin seed, cardamom seed, fenugreek seed, Jamaica ginger, cayenne pepper, pimento, black pepper, long pepper, cloves, and nutmeg. Curry is a compound of the finest spices in the world mixed together in a distinctive blend.

Since the long ago days when the great countries of the world fought for the spice trade—when the Dutch wanted a clove monopoly so badly that they burned the clove trees on the Banda Islands; when the English took Ceylon away for its cinnamon; when the Spanish slaughtered the Aztecs for vanilla beans—spices have changed the whole aspect of the world. Empires, cities, commerce, and the arts have lived or died under the influence of spice.

Even now spice is important. During the World War garlic was used as an antiseptic for festering wounds. Cloves still are used in dentifrices, mouth washes, and antiseptics. Cinnamon, pepper, nutmeg, vanilla, chocolate, and mace are still highly valued in cookery, no longer to hide unpleasant flavors or half-spoiled foods but to enhance the good flavors already present. Today, spices may be less necessary in marking the difference between dining or just eating, yet even now there are three million clove trees, unhampered by restrictions or monopolies, growing on the islands of Pemba and Zanzibar; vanilla is still grown in Mexico and Mauritius; pepper is still in demand in all the countries of the world. Now, however, there are no Malay pirates

lying in wait off Java Head, nor are there Spanish, Dutch, or Portuguese pirates in the Sunda Straits. Past Singapore go the spice ships today, safe from all but hurricanes and typhoons—ships which bring to the New World and the Old a scent and a savor of the spice islands.



ALL-SPICE

You will find more about spices and history in the following books:

BEAGLEHOLE, J. C. *The Exploration of the Pacific*, A. and C. Black, Ltd. London, 1934

DULLES, FOSTER RHEA, *The Old China Trade*, Houghton Mifflin Company, Boston, 1930

FOSTER, WILLIAM, C. J. E. *The East India House*, John Lane the Bodley Head, Ltd. London, 1924

HOSKINS, HALFORD LANCASTER. *British Routes to India*, Longmans, Green and Co. New York, London, 1938

MARTINEAU, HARRIET. *British Rule in India*, Smith, Elder, and Co. London, 1857

PEATIE, D. C. *Cargoes and Harvests*, Appleton, 1926

REOGROVE, H. S. *Spices and Condiments*, Sir Isaac Pitman and Sons, Ltd. London, 1933

ROBBINS, W. M. and RAMALEY, FRANCIS. *Plants Useful to Man*, P. Blakiston's Sons and Co. Inc., Philadelphia, 1933



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THE INDOOR EXPLORER

The Story of a Pioneer "Bone-Setter"

THE first thing you will notice about any mass-produced article is, of course, the impersonal nature of its manufacture. True craftsmanship is something you'll have to look for elsewhere. And one of the best places to find it that this writer knows of is in the display of mounted skeletons offered by the Osteological Hall on the fourth floor of the American Museum. If you go there and look at the skeletal portrayal of Man and Horse, so assembled as to represent the life-like posture of a horse trainer on the run seizing a rearing animal's bridle, you will find the suggestive power of this group compelling you to clothe it in imaginative flesh and trappings. No one examining any of the figures in the collection, from the giant draft horse to the skeleton of the opossum in the act of eating a (skeletal) chick-

When your indoor explorer called on S. Harmsted Chubb in his sunny office in the Comparative Anatomy Department, he remarked that it did his heart good to see such excellent examples of highly skilled personal craftsmanship. After some modest demurrs, Mr. Chubb admitted that he was probably the only "bone-setter" in the "business" who took such pains with his work.

"That's not surprising though," he said. "You see, I've been doing this sort of thing more or less since I was seven years old."

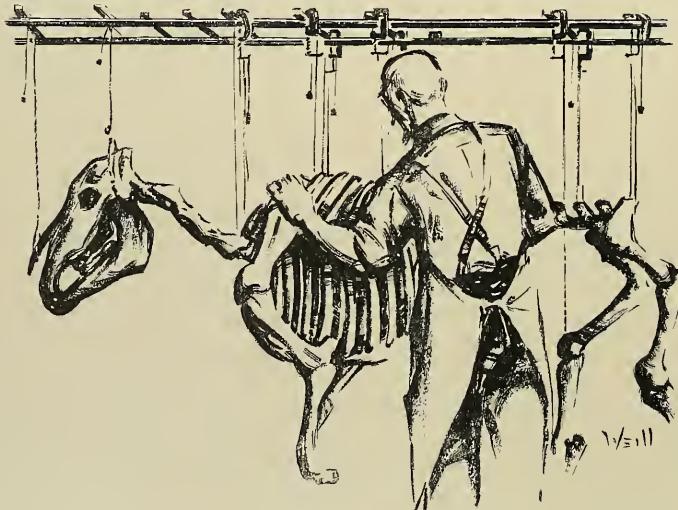
This was how it all started.

The "Bone-Setter" Begins

Not long after the end of the Civil War, S. Harmsted Chubb crawled under the vine-shaded porch of his

she hadn't been, the Museum would never have had that osteological hall. She gravely watched her son excitedly poking the dead animal and agreed with him that it was a very remarkable phenomenon indeed. She had only one reservation: that he examine it outdoors instead of in his bedroom.

Thereafter, S. Harmsted didn't clutter up his bedroom with any more corpses. But that doesn't mean he stopped collecting them. Hiking through the woods, he often stumbled on dead animals, in various stages of decomposition. Some of them were picked clean of flesh and the bleaching skeletons fascinated him. He realized that if you found a dead thing and left it by itself for a while, it invariably resulted in one of these wonderful skeletons. So the roof of



en's head, can fail to realize that he is confronted by the product of patient study combined with the most meticulous craftsmanship. Reading the labels on these exhibits, you will discover that they are all the work of a single man, Mr. S. Harmsted Chubb, who represents a one-man Osteological Department.

father's Maryland house and found a dead cat. Since this was the first time he had ever seen a dead cat, it didn't frighten or sicken him—in fact he *liked* it. So he dragged it out from under the porch and brought it in to show his mother. Fortunately she was the kind of mother who could pretend she liked dead cats too. If

his father's barn became littered with decomposing bodies. Anxious as they were to encourage this early manifestation of a scientific bent, his parents nevertheless felt that the delights of supervised putrefaction could just as well be carried on elsewhere, so they "served an injunction," as Mr. Chubb puts it, on his odoriferous

experiments. A compromise was reached, however. Instead of bringing the fresh corpse to the premises to become a skeleton, S. Harmsted left it in the woods, and then brought home the clean bones.

Being a Maryland boy, it was but a matter of time before he became interested in horses (his interest developed, of course, after finding a dead horse), and he was soon concentrating on a collection of horse's skulls.

At that time, it was the fashion to build "rockeries" in your front yard. These elementary rock gardens consisted of a pyramid of rocks over a mound of earth in which vines and plants were growing. The greenery sprouted through cracks between the rocks, to trail gracefully about on the ground.

Articulate "Skulleries"

This was all pretty enough, but nothing would satisfy S. Harmsted but a "skullery"—the same general idea carried out with horse skulls instead of rocks. Now this contribution to landscape gardening would probably have come off all right if his father had not happened to be a country doctor who noticed that the introduction of the "skullery" and the falling off of his practice coincided. It soon occurred to him that a jittery patient approaching a doctor's front lawn would scarcely be reassured by heaps of macabre horse skulls gushing vegetation from their grinning teeth. So another injunction was served on the juvenile scientist. He was made to uproot his skullery, but he soon found other things to do with the skulls.

Partly because he was interested in the movement of parts in a horse's skull, and partly because he was determined to keep his large collection on exhibition, he removed his field of operation to the roof of a woodshed near the house. His long-suffering parents suspected nothing, and were doubtless happy to hear him hammering away, hoping perhaps that he had developed an interest in carpentry.

Actually S. Harmsted was disarticulating the lower jaw from each of his skulls and fastening it firmly to the edge of the shed's roof. He then affixed the top portion of each skull to a hinge. Also connected with the top of each skull was a stick, driven through the *Foramen-magnum* which he did not then know by this scientific name but merely regarded

as the brain chamber and a convenient place for a stick which would serve his purposes. To each stick he attached a long string. When all was ready, S. Harmsted hid some distance away and proceeded to manipulate the skulls as one does puppets.



One is left to imagine the exasperation of his father at the latest of his son's experiments. Your indoor explorer likes to picture him wearily returning from his professional calls around the countryside, pulling up at last in his own yard, only to be greeted by a row of skulls on his woodshed, gnashing their teeth at him, apparently of their own volition.

The Bone-Setter Arrives

Unlike so many youthful hobbies, Mr. Chubb's interest in osteology did not vanish with the years. When the time came for him to earn his own living he began visiting museums throughout the country with the idea of apprenticing himself to one of these institutions. Greatly to his surprise, he found that the vast majority of the skeletons on exhibition were not only incomplete but in many cases far inferior to the work he had already done. The prevalent inadequacies of the mounted skeletons he examined filled Mr. Chubb with the resolve to revolutionize osteological preparations. To this end he brought his masterpiece of that early day, (the same skeleton of an opossum in the act of eating a chicken's head which you will remember is still on exhibition), to the late President Osborn at the American Museum. The latter was so pleased with his work

that he was shortly installed as Museum osteologist and has remained in that capacity ever since.

"I can see that your method of skeleton mounting is different," said your indoor explorer when Mr. Chubb had finished his story "but I can't tell what makes it so."

Mr. Chubb thought for a moment. "Well, the best way I can start explaining it to you," he said at length, "is to tell you about some of the commercial 'bone-setters.' "

Museums—C.O.D.

Your explorer learned, to his surprise, that mass production had even entered the field of "bone-setting," indeed it had crept into the "museum business" as well. It seemed that there was a certain long established firm that mounted skeletons via the conveyor belt system. This firm, Mr. Chubb said, will supply you with any number of mounted skeletons for a price. And, if you should happen to want a whole museum of your own, they can gather practically all your collections for you, perform the taxidermy, assemble the groups, and ship them off C.O.D. "Of course," he smiled, "as far as the scientific accuracy of their work goes, it's your gamble." At this point your explorer asked Mr. Chubb if he had ever thought of taking a job in the "bone-setting" department of this establishment. He smiled and shook his head.

"No," he said, "I'm afraid I wouldn't be very successful as a commercial skeleton mounter. You see, it took me nearly a year to mount Sysonby's skeleton—that champion race horse you saw upstairs. His skeleton is mounted with each bone and joint fixed just the way they were when Sysonby was in full stride on the race track, and if I may say so, I think you will find precious few skeletons where the mounter has taken the trouble to work out, authentically, every single articulation that occurs in the running animal. Naturally, if I were to build skeletons commercially, I'd be expected to turn them out a lot faster than once a year." Mr. Chubb went on to say that he wouldn't be very interested in throwing together a long series of slipshod skeletons even if he could make himself work that way. All the delight of the craftsman in his own art would be lost.

"Bone-setting" in the hands of Mr. Chubb has become a craft combining

the best features of both art and science. If this commercial "bone-setting" house were to take up the task of producing a bunch of mounted horse skeletons, they would build a series of angular, and unnaturally rigid, structures made up only of those larger bones that could easily and quickly be pieced together. They would simply throw away any bone that didn't seem to have an obvious functional place in the skeleton. Not so Mr. Chubb. "It is at this point," he said, "that the work begins to get really exciting." In addition to the amount of time and effort he has devoted to the ticklish mechanical problems of his job, Mr. Chubb has spent long hours in the study of osteological evolution. He is, therefore, ever on the lookout for the very bones that the commercial worker so impatiently casts aside.

A "Skeletal" Detective

Mr. Chubb reached up and removed a small laboratory bottle from the shelf. The bottle was partly filled with a colorless liquid which later turned out to be H_2O and contained what seemed to be a sliver of bone less than an inch long. Mr. Chubb took a pair of tweezers and lifted the bone out, holding it up in the light.

"That," he said, "is the fibula of a wild ass."

Your explorer searched Mr. Chubb's face for some sign that this gentleman was "having one on him." But Mr. Chubb proceeded to explain that members of the horse family had only one functional bone in the lower portion of the hind leg (the tibia). And although instances of obvious though useless vestigial fibulae in individual animals are well known, Mr. Chubb's keen eye has ferreted out a considerable number of tiny equine fibulae—many of them reduced to the diameter of a hair—as evidence of their theretofore unsuspected diffusion. Fibulae are, however, fast disappearing from the limbs of the horse family; it is in the human leg that they attain their most luxuriant proportions.

"And this little bone . . . ?" asked the writer, peering into another laboratory bottle.

"Is a tooth—a canine," replied Mr. Chubb, plucking it forth with his tweezers. "Only very rarely do you find a canine tooth in a female of the horse family, and when you do it is vestigial and, like this one, no longer functional."

The horse family's canine, your explorer learned, was once a sharp offensive weapon but is now of little use in any mouth adapted to grinding the contents of a feed bag.



"I have never investigated the influence of vestigial bones on animal personalities," twinkled Mr. Chubb, "but I suspect the old lady who owned this tooth was a particularly cantankerous beast."

All these tiny vestigial bones, Mr. Chubb explained, were intensely interesting to the student of evolution. Each one of them was carefully filed away in its own bottle, and if he mounted the skeleton of the animal from which each was taken, Mr. Chubb was always careful to include the bones in their exact positions. If the skeleton was not mounted, the little bones were clearly labeled and placed in what Mr. Chubb calls his circulating library, where they are always available to any scientist who wishes to study them.

Taking It Apart

"I was wondering," said your explorer, "if you could give me some rough idea of just how you go about securing and mounting the skeleton of a dead animal." It was very much like taking a fine Swiss watch apart and then trying to put it together again, Mr. Chubb explained, only it was a lot more difficult.

Dissection was the first step. In this process as much of the flesh and tendons as can be cut away without injuring the bones is eliminated. Throughout these dissections, Mr. Chubb measures the various parts, making notes on minute articulations and such relationships as in life are complemented by the sinews and tendons that hold the bones in place. Sometimes, as an added insurance of perfect reproduction, plaster casts of certain parts are made

"Then, I suppose you take off the remaining flesh with chemical solvents?" asked your explorer.

"No, I don't," said Mr. Chubb emphatically, "and I'll tell you why. Years ago I had so much work on hand that I was forced to entrust some of it to those commercial preparators we were talking about just now. These fellows did use powerful acids to clean off the flesh, but unfortunately, they also cleaned off so much of the bone as well that there wasn't much skeleton left for mounting. However, I didn't let this prejudice me. I experimented with chemicals myself, but they were too much for me. I just couldn't keep them under control."

"Well, then, do you keep on scraping till the flesh is all off?" asked the writer.

"Wrong again," smiled Mr. Chubb. "If I did that, I'd be liable to lose a lot of those fascinating little vestigial bones, because so many of them are very ingeniously hidden among the tendons. Furthermore, scraping might mar the bone surface itself."

"Well, I give up," sighed this indoor explorer. "How do you do it?"

"I let it rot."

Sitting Up With A "Rotter"

Mr. Chubb arose, walked over to a corner of his laboratory and pushed back a screen. He then called the writer over to see what appeared to be a perfectly ordinary bath tub somewhat elevated from the floor. Underneath the tub were three bunsen burners. "This is where the maceration (which is simply a fancy name for rotting) takes place," he said.

"You mean you put the dismembered animal's bones in that tub?"

"Precisely," said Mr. Chubb. "I then fill it with water which I keep at a constant temperature of about 100°. The water must be just hot enough to aid the maceration, but not so hot as to stain the bones."

"How long does it take you to—uh—macerate a skeleton?"

"Between two and three weeks."

"But how is the temperature kept constant for that long a period?"

"Why," said Mr. Chubb, "I have a little bunk over there in the next room, and I simply stay here in the Museum the first few nights, snatching a cat-nap whenever I can. It's really much less strain than trying to go home for an hour or two and live

like a gentleman, so I just sit up with the macerating animal."

"You couldn't get something to control the temperature automatically, could you?"

"Oh, I suppose it could be done, but it would be expensive and, frankly, I like to feel that the bones require my personal supervision at every stage of the game."

After the bones are cleaned of all flesh by the slow but sure process of maceration, they must be thoroughly and carefully freed of all grease and fatty matter. The roof of the Museum is implemented by Mr. Chubb at this stage of preparation much as the roof of his father's barn during his childhood experiments. Here the bones are placed in tanks filled with benzine, which dissolves everything that might mottle the pure color essential to the esthetic appearance of the mounted skeleton. The benzine must be changed three or four times during this period. If it isn't it will become saturated with grease and leave a gummy, discoloring deposit on the bones. This degreasing procedure may therefore take as long as six or eight weeks. Everything depends on the amount of sunshine and the size of the bones.

Putting It Together

"And the final stage of the game is fitting the clean, dry bones together," said Mr. Chubb. "Right now I'm working on a mountain zebra," and he pointed to a large skeleton suspended by a seemingly infinite number of cords on a rack directly behind us.

The writer turned. "Well, I'm glad we've gotten around to this," he said. "Frankly, I've had my eye on it since I came in."

Mr. Chubb laughed. "I call this my osteological Christmas tree. Here, sit down and I'll tell you all about it.

"First I get a steel rod just large enough to pass through the neural canal of the spinal column—the place where the nerves used to be, you know. I have already determined through photographic studies made at the Zoo what posture to use for my zebra."

"So this was a zoo animal?" asked the writer.

"Yes, this particular zebra belongs to a South African species that is dangerously near extermination. She lived in the Bronx Zoo after being brought to this country and died re-

cently when she was about thirteen years old."

"And what posture will you fix her in?"

"It's going to be a walking position. So I have to work the rod and spine into the shape it would take in life when the animal was in action. After I've hung the vertebrae tentatively in place, I arrange the bones of the legs, always keeping one eye on my photographs and measurements and the notes I made during dissection. I never permanently fix anything at this stage, because continual adjustments in the angle of the joints have to be made. So I suspend most of the large, heavy bones on looped cords which pass over the heads of these small screws you see inserted into the bone at various points. The other ends of the cords are wrapped a couple of times over the horizontal rod on top of the frame and those small weights over there are attached to the free ends of the cords, so that nothing will get out of line.

"Now for the ribs. And this is a long operation. I take a small, pliable strip of steel and fix each rib on it by means of a rubber band. Another rubber band joins the rib temporarily to its vertebra. When each rib seems to be properly placed, I make a permanent steel brace and fasten the ribs to it with these little screws.

"As I get the adjustment nearer and nearer perfection, I see errors in this part or that which were not obvious when the bones as a whole were out of position. It is simply a process of eliminating the errors one by one."

While he was speaking, the writer's eyes fastened on a nearby piece of machinery. "That looks like an instrument of torture with which I'm all too familiar," he said.

"That's right," chuckled Mr. Chubb, "it is a dentist's drill. When I've completed the preliminary adjustments to my satisfaction, I drill small holes where the bones come in contact with each other and drive steel wires through the holes just tight enough to hold firmly, but not so tight as to spread the bones. These wires are driven down just a little below the surface of the bone, and the small holes which result from this operation are filled up later with plaster. And there is our skeleton—ready for exhibition."

"Doesn't the work become monotonous or tiring after so long a job?"

"Never. Never. I enjoy every minute and every step in the procedure, from manufacturing my own little plumb-bobs which I use on my scaffold, to fixing the last small bones in place. To me, it's the most thrilling and satisfying work in the world."

—D. R. BARTON.

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THE LONDON ZOO

----- by E. G. Boulenger

E. P. Dutton Co., Inc., \$2.00

MR. BOULENGER has produced an elaborate guide book of the London Zoo. While there is fair zoological continuity in treating his animal subjects, this is interrupted and shifted here and there, in leading the reader from one building or animal installation to another; and it is not possible in zoos to align the exhibits in the precise ways of formal classification. The book is prepared in clear and sprightly readable terms. The author has sought to give the animals, small and large, marked individuality. There is much about their variable temperaments as captives, and about their general habits and structure. Thus the book may also be regarded as a condensed natural history. It treats with mammals, birds, reptiles, amphibians, fishes—even with the inmates of the London Zoo's insect house.

As an example of the information to be derived we may pause at the chapter entitled, "The Kangaroos." After learning considerable about these animals, there is elucidation about the birth of kangaroos, a subject that has been surrounded with much conjecture. The author explains:

"The precise manner in which the infant kangaroo comes to take his place in the pouch is a discovery of relatively recent date. For a long time it was believed that the infant was born in the pouch or placed there by the parent, but careful observations at the Sydney Zoo have disproved both these theories. It appears that the baby is born in the usual manner and is cast upon the world quite blind, naked, and of remarkably diminutive size. The newly born young of the giant species is not much larger than a new-born mouse, whilst those of the smaller kinds might be mistaken for maggots. The birth having been effected, the infant is left to crawl on knees and elbows in a search for the pouch and should it not strike the right road from the first, dies of inanition. If all goes well, however, it struggles on until it finds the maternal abdomen, when it fights its way upwards through the fur until safely lodged in the pouch. Here the little kangaroo finds the necessary nourishment. It stops in the pouch for many months, and though ejected when it grows too bulky, may remain 'at

nurse' for fully eighteen months. It is not uncommon indeed to see a well-developed kangaroo with its head deep inside the pouch whilst the legs of yet another nursing protrude from the same orifice like a bowsprit. It is not always possible to say how old the zoo kangaroo is when it first shows itself in public, since introduction to the pouch is effected with the utmost secrecy."

With such information scattered through the text, there is much to be gleaned from Mr. Boulenger's book, his procession of subjects ranging from the anthropoid apes through the invertebrates.

A study of its pages and particularly good photographs should be an inspiration to young people visiting any of the zoos or museums.

RAYMOND L. DITMARS.



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AMERICA'S YESTERDAY

----- by F. Martin Brown

J. B. Lippincott Company, \$3.50

POPULAR books concerned with anything approaching a comprehensive story of New World archaeology are very rare. Most recent attempts have emphasized one or more high points in this complex and fascinating story at the expense of the whole. In the present account, which is readable and furnished with excellent illustrations, this is not the case. Mr. Brown has not only given a vivid and excellent summary of the Southwest, with which region one suspects he is most familiar, but he has gone on and sketched in the tentative outlines of some seven or eight other important New World centers of civilization. In Mexico, and to the south in the Maya region, he discusses the early civilizations of the valley, their culmination in the bloody but fascinating Aztec culture, and their underlying relationships to the great Maya achievements in calendric reckoning, city building, and the fine arts. His appendix of Maya dates, expressed according to the two generally accepted correlations, like that for the Southwest which gives the tree ring dating for important ruins, will be useful to scientific archaeologists as well as laymen.

Unlike some popular writers on these subjects, the author does not proceed directly from the Maya to a consideration of the great Inca Empire of the Andes but, in passing, briefly considers the intermediate and important civilization of southern Central America and northern South America. In regard to his statement that the higher civilizations of the southern continent were undoubtedly derived from those to the north certain qualified archaeologists might dissent. However, the northern or southern origins of high civilization in the New World are still matters for debate. In his treatment of the various pre-Inca civilizations, as well as in the outlines of the autocratic-communistic civilization of Inca times, the author gives a vivid and generally accurate picture. The illustrations of major ceramic types and the airplane views of important sites are well chosen and striking. Returning to the north the mound-building peoples of the Mississippi valley are considered in a somewhat summary fashion.

From the technical standpoint there are

a few factual errors and numerous misspellings occur in the text. To the reviewer these seem less important than do certain general statements in the introductory and concluding sections. The former, neglecting as it does certain significant early sequences in the Great Plains and adjacent areas as well as in southern South America, is not clarified by bringing in a very brief and not too accurate discussion of Old World archaeology. The conclusion, which suggests either an age of 100,000 years for man in America or the possibility that man originated in the New World, seems fantastically unrelated to the rest of the text. All present archaeological and geological findings indicate that man of the present species entered North America from Asia during or just after the glacial period and for some time lived in association with mammalian forms now extinct. Whether there may have been an interglacial invasion remains to be determined but any belief in a New World origin of man himself seems far less tenable than ever before. Since the author's conclusions in this case do not seem to follow the data presented it is difficult to understand why they are brought in. However, at the present time no person could write a general treatise on the New World prehistory that would receive universal endorsement. The present book, aside from the disputed problem of origins, is in general, factual, convincing, and well written. It can be read by the layman with enjoyment and by the critical student with profit.

WM. DUNCAN STRONG.

HAWAII: Isles of Enchantment
- - - - - by Clifford Gessler

Appleton-Century Co., \$5.00

HAWAIIAN TAPESTRY
- - - - by Antoinette Withington

Harper and Brothers, \$3.50

IFE we on the mainland continue to remain in ignorance of Hawaii, it certainly is not because of the paucity of books being written about these insular possessions of the United States. Within the last few months I have read four new books about Hawaii; two of them sociological and the two under review of a more general and impressionistic character.

Clifford Gessler in *Hawaii: Isles of Enchantment* has, in his own words, tried to write a "national biography" and to paint a "character portrait" of his beloved islands. He has done it with charming words and with delicate color. Mr. Gessler obviously loves Hawaii in all its natural as well as artificial beauty, and I have never read a more poetic or deeply felt description of it. He manages to evoke the sight, the sound and the smell of these enchanted islands.

When Captain Cook discovered Hawaii in 1778, he literally found a lost world. Cut off by vast seas from communication with the Asiatic mainland for a millennium and the rest of Polynesia for centuries, the Hawaiian islands formed a solitary but happy universe, teeming with handsome, vigorous people. The arrival

of Cook, who seemed to the Hawaiians to be a god, marked the end of their sweet solitude. It set in motion two processes; one internal and in a sense constructive, the other external and destructive.

Before the coming of Cook and his successors, Hawaii was governed by local chieftains with rather vague overlords. One of the most ambitious of the chiefs, Kamehameha, aided by European arms, undertook to bring all the islands of the group under subjugation. After a series of epic conflicts he succeeded in establishing himself as king of the Hawaiian Islands. When the first missionaries arrived from New England in the 1820's, they encountered a firmly fixed royal family. Nowhere else in Polynesia had such centralization of power occurred. A similar attempt was encouraged by the similar introduction of foreign arms in Tahiti, but the attempt failed, partly, I suppose, because there the missionaries interfered. This process of centralization in Hawaii was a natural development of the devices inherent in Hawaiian life and was hastened by the unequal utilization of firearms.

But while Hawaii was being united under native rule, its system of living was being destroyed by the introduction of foreign ideas. The "tabu" on which much of Polynesian life rested was undermined. And the native population was being decimated by new and violent diseases and habits. In the second half of the 19th century the population of Hawaii had been reduced almost to an eighth of its size when Cook had discovered the islands. The royal line continued but through its own ineffectuality and through economic pressure it finally succumbed to the stronger external influences, and the islands were annexed to the United States in 1898.

The annexation came about largely because of sugar. If cotton is king in the South then sugar is queen in Hawaii. After a number of unprofitable attempts to grow sugar in Hawaii, the plantation system gradually became established in the middle of the last century; and after the passage of the reciprocity agreement with the United States in the 1870's, it flourished. Since the United States was Hawaii's best market, the economic situation inevitably forced the islands into closer association with this country and finally into annexation as a territory. Today sugar is the most important product of Hawaii, seconded only by the pineapple industry.

But sugar, or rather its requirements for cultivation, has not only been responsible for Hawaii's political and economic life, it has also fundamentally altered the character of its population. The depleted Hawaiians proved unsatisfactory for the labor needs of the sugar plantations, and other sources were tapped to supply them. Chinese, Portuguese, Spaniards, Koreans, Porto Ricans, Japanese and Filipinos were introduced in large numbers to work the sugar fields. Some died in the islands, others returned, but many remained in Hawaii. Besides these strains, Europeans and Americans of various origin have also settled in the islands. Today Hawaii is once more re-

populated, but the ancient Hawaiian is now in a minority. All these varied stocks soon come under the influence of Hawaii and are molded in the island pattern. The genius of Hawaii remains.

Mr. Gessler traverses many of the varied roads to Hawaii; historical, racial, economic, sociological and geographic. He describes the various aspects of the group, island by island. He touches on such items as the ukulele, the hula, the luau or native feast, and the local intoxicant called okolehau. He describes the life of Honolulu, including Waikiki with its beach boys and flimsy cottages, and the quieter life of the plantations. But he lingers longest on the natural charms of Hawaii. Although this is no starred Baedeker, it is a guide book in its best sense, because it is enthusiastic, covers its allotted territory and activities and is written with grace.

The illustrations by E. H. Suydam form a lovely complement to Mr. Gessler's writing.

Mrs. Whithington's *Hawaiian Tapestry* is similarly devoted to the effort to capture the quality of Hawaii. She succeeds less admirably than Mr. Gessler, although her account is entertaining and makes pleasant reading.

H. L. S.

NATURALISTS OF THE FRONTIER

- - - - - by Samuel Wood Geiser
with a foreword by Herbert Spencer Jennings

Southern Methodist University, \$3.00

THIS book contains biographies of ten of the men who collected plants and animals, including fossils, in Texas during the middle portion of the 19th Century.

Conditions were hard in the Texas of those days and he who lived among them, particularly if his living depended upon selling specimens to "closet naturalists," could not well carry on the studies that would lead to scientific publications. Undoubtedly Doctor Geiser is right in saying that "too often the scientific explorer has borne the burden of the heat of the day, while the closet naturalist has reaped that whereon he bestowed relatively little labor."

On the other hand, there are men who are much better adapted to the "frontier" than they are to the "closet." At least some of the ten in this book are of that type. There have been many mutually satisfactory partnerships between fieldmen and students, each doing the work either to which he is better adapted or for which he has better opportunities. The story as it is told here of, for example, Asa Gray's treatment of Ervendberg is not pleasant; but it should not be (possibly the author did not intend it to be), considered typical of the relations between student and collector.

The ten whose lives and labors are discussed are Boll, Berlandier, Drummond, Ervendberg, Lindheimer, von Roemer, Wright, Lincecum, Reverchon and Belrage, of whom Wright and Lincecum were the only native Americans and Lincecum the only "true son of the frontier."

FRANK E. LUTZ.

TOOMBS, TRAVEL, AND TROUBLE

— by Lawrence Griswold

Hillman-Curl, Inc., \$3.00

TOOMBS, TRAVEL AND TROUBLE is an adventure book highly exciting and very personal. It is also in spots very funny. It covers the author's experiences in Latin America, in the Philippines, in Bali, and finally trapping giant lizards on the Island of Komodo. One is left with the impression that Mr. Griswold is a very dashing and daring man, but that what he has written is of no use to the traveler, the student, or the organizer of an expedition.

It must be granted that when one is doing deeds of derring-do, he has no time to take photographs, but it stuck in the reviewer's craw to see a photograph of the author of the book and his companion posed before a plaster cast of a serpent column at Chichen Itza, with the implication that picture was taken *in situ*. Also the author's use of the term "archaeologist" was rather broad, since none of his results have been published in the technical journals.

Mr. Griswold writes, however, with gusto and humor, and it was conceivably a great feat to trap the giant lizards of Komodo. *Tombs, Travel, and Trouble* is very diverting, and it is probably just a matter of the reviewer's personal taste that he dislikes to have roaring good adventures dished up as a by-product of serious scientific research, in which there is no trace of any activity on the part of Mr. Griswold.

GEORGE C. VAILLANT.

EARTH-LORE: Geology without Jargon

— by S. J. Shand

E. P. Dutton and Co., Inc., \$1.25

PROFESSOR SHAND, who has recently joined the faculty at Columbia University after teaching for some years at the University of Stellenbosch in South Africa, has given us, in *Earth-lore*, the most readable volume designed to present the facts of Geology in terms understandable to the non-geologist that has come to hand in the past few years.

Though only 144 pages in length, in this little book are to be found most of the essential facts of physical geology and a great number of the accepted and rejected theories which attempt to explain the world as we know it and how it came to be. The interest of the reader is maintained by the method in which the subject is treated. The author outlines only a sufficient amount of known fact to permit the introduction into the discussion of some theory which has been advanced to explain the conditions found and then the major body of data is marshalled as tending to support or disprove this theory. While this method may at times give a somewhat one-sided interpretation, nevertheless, it does serve to

keep interest at a high level throughout.

The author digresses from his general topic only once. A chapter, "The Creation Saga" is a review and refutation of the Hebraic cosmogony as presented in the book of Genesis. This is not geology in the strict sense, and the reviewer is of the opinion that it is best in a book of this type to present the facts and conclusions of geology as to the origin and age of the earth and let them speak for themselves.

In the purely geological discussions, one chapter falls below the standard set by the rest of the work. In his discussion of the theory of Continental Drift, Dr. Shand outlines the facts which have led to the development of the concept of drifting continents and discusses at some length the explanations offered by Wegener. Finally, concluding that certain fundamental considerations tend to disprove that hypothesis he offers instead the older concepts of Suess and Taylor. No mention is made here of the theory of Permanence of Continents and Ocean Basins and, in fact, the whole treatment is such as to give the non-scientific reader the impression that there is no question but that the continents have drifted and probably still are drifting, and that the whole problem is that of determining the motivating factor. This rather one-sided discussion is further complicated by somewhat contradictory statements, and one or two errors of fact. Perhaps the most obvious of the latter is to be found in the assertion that "The nearest living relatives of the Australian kangaroos are the South American opossums." Following, we find that "in order to explain their distribution, one must either believe that creatures identical in every respect originated independently at half a dozen different centers, or else that the lands in which they are now found were at one time united." The known evidence and explanatory data offered by paleontologic distribution is not mentioned.

On page 128 it is shown that, if North and South America are brought into juxtaposition with Europe and Africa, the trend of the mountain ranges of the adjacent portions of the two hemispheres seems to line up in a suggestive manner. This is used as evidence supporting the concept that the two areas were originally a portion of the same land mass. But on page 135 we learn that if the Wegener hypothesis is incorrect then the Appalachian mountains of North America and the mountains of the Cape of Good Hope are examples of mountains that can be explained as formed by the resistance of the material of the ocean basins to the drift of the continental masses.

Statements such as these appearing in a book designed for the non-scientific reader make the reviewer somewhat hesitant to recommend it whole-heartedly, despite the desirable nature of the presentation and treatment of the major portions of the volume. If it were not for these inconsistencies I would毫不犹豫地 call this book the most satisfactory of its kind that has appeared in the field of geological literature in the past several years.

H. E. VOKES.

THE WORLD IN MAPS: A Study in Map Evolution

— by W. W. Jervis
Oxford University Press, \$3.00

THE author of this work is Professor of Geography in the University of Bristol, England. His main theme is the story of the origin and development of the map-idea down through the ages. It is a fascinating as well as a useful book. The history of such features as scale, distance, direction, projection, detail, relief and lettering, is discussed in a most interesting manner in the first six chapters of the book. The opening paragraph of the chapter on detail runs as follows:

"Maps are inventions, and like other inventions that have complicated life and made civilization, they have grown and developed. They started, like the motor car, crude, comic and almost useless. They have developed in two or three thousand years as the motor car has developed in twenty. Both are now things of beauty, of perfection almost, and of abiding utility."

The development of the instruments used in map making such as the back-staff, compass, measuring wheel, plane table, theodolite, and transit theodolite are also figured and discussed in appropriate places. The book is a handy reference book on the history of map making and should be in every library.

CHESTER A. REEDS.

EDWARD WILSON: NATURE-LOVER

— by George Seaver
John Murray, London, 10s 6d.

THIS beautifully produced biographical volume is partly the vicarious fulfillment of its subject's great desire to write a book on Natural History illustrated by his own drawings; and partly a response to requests for further details of his work from readers of *Edward Wilson of the Antarctic* (1933) in all quarters of the world.

The author of the *Life* has now made a supplementary portrait of his friend as naturalist and artist which consists mainly of excerpts from Wilson's diaries and letters. These will not only be of interest and value to students, but will reveal to the less specialized a man who spent himself in generous service, and used his great powers to share with others his vision, at once scientific and mystical, of the natural world.

Edward Wilson's devotion to, and genius for, outdoor observation began when he was a schoolboy in his Gloucestershire home. There he passed his free time in the neighboring woods, training his eyes and ears to extraordinary perceptiveness. At his preparatory school he started a rage for painting everything, chiefly birds; and at Cambridge his rooms resembled a museum rather than a dwelling place." During his medical course a physical breakdown with symptoms of tuberculosis, obliged him to leave the hos-

pital and spend the years 1898 and 1899 under treatment at Davos and traveling in Norway. On his recovery he qualified for his degree and prepared for the Antarctic Expedition which he had been urged to join. He sailed with Scott on the *Discovery* August 5, 1901. The voyage to the Cape was his opportunity to study and draw the microscopic contents of the tow nets, strange fishes, and sea fowl . . . "his object being to enlarge and paint up correctly a series of characteristic pictures of every pelagic bird seen."

A landing made at the Macquarie Islands introduced him to King and Royal Penguins, with their respective methods of incubation, and a vivid detailed account of Emperor and Adelie Penguins from Wilson's journal is given in this book. Although he performed his full share of the Expedition's labors, undertaking the taxidermy work himself, and contributing to the meteorological and biological sections, he still contrived to make his wonderful Antarctic sketches.

Wilson studied the fauna and flora of the Auckland and New Zealand on the way home, and after his return was fully occupied, first in helping to prepare the reports of the Expedition for publication, and then in his appointment as Field Observer to the Grouse Commission. Joining Scott's Last Expedition (1910-1912) he added a hundred paintings to his portfolio before making "the worst journey in the world" with Cherry-Garrard. His part in the final scenes belongs to heroic history.

MURIEL KENT.

OVER THE NORTH POLE

----- by George Baidukov

Harcourt Brace and Company, \$1.50

THIS is the story of a pioneer flight over a difficult route, told simply in the first person and translated from the Russian. Its historical importance arises from its being the first transpolar airplane flight and a significant step in the development of distance-saving commercial routes between the two hemispheres.

The formation of ice on wings and windshield, an accidental overflow of valuable oil, and a frozen radiator which had to be replenished from the meager supply of drinking water, lend drama to the narrative. The flight reached an altitude of over 19,000 feet at times, and oxygen was used by the men. In flying just to one side of the North Pole, the three aviators were not able to sight the other Soviet explorers who were somewhere below them preparing for their long vigil on the drifting ice.

The book expresses the strongly national spirit which has motivated the recent Soviet work in exploration; and a preface by Vilhjalmur Stefansson points out the place which the flight occupies in the history of exploration. If a monument were to be erected to these flyers and the second group who made an even longer flight over the same route, writes Stefansson, it might well be inscribed: "They found the world of transportation a cylinder; they left it a sphere."

E. M. W.

THE PAGEANT OF THE HEAVENS

by Frederick Warren Grover, Ph.D.

Longmans, Green and Co., \$3.00

THE above elementary work by Professor Grover of Union College introduces astronomy by observational work. Besides this it treats of the motions of the celestial objects as they pass across the sky. Many pages describe the constellations as they appear at different seasons and in different regions of the sky. The author also explains apparent motion, seasonal change, sidereal time, star names and positions, and the stellar pageant as it changes with our change of latitude. He elaborates on the sun's apparent path among the stars, and explains solar time, heliacal rising of stars, measuring of time and longitude, and the difficult subject of precession of the equinoxes, also the seasons in different latitudes. Then the author describes the sun, moon, planets, eclipses, occultations, comets and meteors. Many quotations of poetry occur in the text.

The author introduces the reader to the Milky Way, the brightest stars, nebulæ, double and variable stars, and novæ. Circular star charts are included with the book, with white stars on a black background, to be used with a flashlight underneath.

The reader will likely be pleased with the high quality of the English and the passages from Milton and others, but the advanced astronomer will object to the planet charts plotted for 1934-5 (!) on the very confusing ecliptic charts (which also have the co-ordinates of right ascension and declination plotted, adding to the complexity). Also there occurs the customary Eros error, where it is said this asteroid is the nearest one to approach the earth, whereas there are several others known that come closer. Besides, the constellation names contain many mistakes, as they do not conform to the approved terminology. Certain of the symbols and pronunciations are incorrect, and the reading list should be altered.

HUGH S. RICE.

THE LADY AND THE PANDA

----- by Ruth Harkness

Carrick & Evans, \$2.50

Giant pandas are news, and any story about them is certain to be most fascinating, for they are strange and interesting animals.

Hardly can we realize that in this late day of our civilized and well-trodden world there could come to light a big, brand-new animal, which has remained tucked away from man's reach for all these years. Paradoxical as it may seem to hard-boiled explorers, it took a woman to go and get it.

Ruth Harkness tells in her own very delightful and intriguing way the story of the first one to be brought out alive

from those remote and forbidding mountains in the far, back country of China.

A dress designer in New York, she became fascinated with the plans of a young man whom she had known for a long time. He was to seek the giant panda, and just before he sailed they married, only to leave her behind for a year or so, while he went on with his venture. He died in Shanghai, and she finally came there to carry on.

How she, who knew nothing of what exploration was all about, became intrigued with the thought of it and started out to do the impossible, while all her friends called her "crazy," lures one to read on. She finally plunged into the back of beyond, and after seemingly insurmountable difficulties and heart-rending disappointments, when her courage and money were all but gone, the "one in a thousand" happened, and a baby giant panda came to her camp, unexpectedly caught by her natives while they were building traps in the remote hope of catching one alive.

With success in the field, her next problem was to care for it and bring it out alive, a task which took constant and unfailing care.

The story is delightfully told, very well written and most amusing. Mrs. Harkness tells of the people, their ways and how they live—happily, although in poverty—and of the trying, not to mention dangerous, situations, which would confront any woman on such a journey when traveling alone.

One is left with the greatest admiration for her unfailing ability to meet the many difficulties and carry through. Few women could have done such a trip, and fewer still could have done it alone.

It is a charming story of a really hard and commendable trip, very well told and certainly delightful to read.

JAMES L. CLARK.

DARK SKIES—Continued from page 178
of a halfway haven, with the merciless lee shore of Chandu on our beam from daybreak until dark.

Thirteen hours later we have our lead in the quiet shelter of Puná, and anchored at the edge of the channel near the lonely mouth of the Rio Guayas. The winking of a lighthouse seemed peculiarly strange and endearing. Only a few cupsful remained of all the 805 gallons of gasoline we had pumped in and consumed. What cared we? Our 1,065 miles in a cockle shell were now behind us. We had wangled our way out of the many-fingered clutches of the sea.

Museum and author wish to express their grateful indebtedness to Mr. E. Hope Norton, who supplied the craft for this expedition, and to Mr. Jesse Metcalf, whose contribution defrayed other costs. Appreciation is due also to the Grace Line, the United States Coast and Geodetic Survey, the Woods Hole Oceanographic Institution and the American Geographical Society for coöoperating in various ways.

LETTERS

Sirs:

I was on the verge of writing to tell you how delighted I was with the NATURAL HISTORY Magazine when I read the letter of one of your subscribers who complained of its new format.

I cannot understand how anyone can object to the magazine in its present form. It is a thing of beauty, it is easy to read, and its contents are a source of delight, entertainment and education.

I am sure that when more people become acquainted with the NATURAL HISTORY Magazine it will increase tremendously in circulation, and that is after all what we desire—wider dissemination of knowledge of natural history.

Rarely have I ever read anything more thrilling and absorbing than the story "The Facts About Shiva" in the December issue of NATURAL HISTORY. The illustrations add to this extremely valuable article and you are to be commended for their excellence of reproduction.

To me, nothing is more romantic or thrilling than the facts of science and there is no reason in the world why researches in the fields of science should not be presented in a publication as attractively as non-scientific subjects.

JOSEPH LEWIS.

New York City.

* * *

Sirs:

I should like to add my testimony to that of those who heartily approve of the NATURAL HISTORY Magazine in its present format and content. G. R. ERIKSSON.

Detroit, Mich.

* * *

Sirs:

I noted in your January number that you would like an expression of opinion of the present size of NATURAL HISTORY Magazine.

Your new size, in my opinion, is better suited for the purpose than the old. Larger pictures are possible, and fewer pages are necessary for any particular article. The practice of completing an article in small print on the last few pages is, however, rather annoying.

It is suggested that your more "popular" essays be printed straight through in large print, while the more technical articles be also printed straight through in small print.

Your magazine is the most interesting and beautiful of its kind I have ever seen.

GEORGE W. POLK, JR.

France Field, C. Z.

* * *

Sirs:

The late Professor Henry Fairfield Osborn signed my certificate of Life Membership in the American Museum on the 7th February, 1921, just 17 years ago today, and during this period I have received many copies of NATURAL HISTORY. Since 1926 I have been a Fellow of the Royal Geographical Society and have received its Geographical Journal every month for that period. All this has enabled

me to observe certain welcome changes which have been made in both publications.

I believe the greatest improvement has occurred in NATURAL HISTORY and without in any way imitating your "ancient and honorable" British contemporary. You have recently gotten onto the right track by utilizing the wealth of artistic and informative material possessed by the Curators and staff of the Museum, which was formerly overlooked. As I remember my old copies of NATURAL HISTORY, the publication was confined to technical and rather dry scientific articles, interesting no doubt to specialized readers but of little interest to the average member of the Museum. I am assuming one of the primary objects of NATURAL HISTORY is to interest and acquaint its large and ever-increasing membership with the inner workings of the institution, rather than to act as a medium of exchange of strictly scientific data. I happen to be one of those who feel that museums are only understood and appreciated by their curators and that too little effort has been made to interpret the exhibits and knowledge contained within those temples. Therefore, the recent transformation (or evolution!) of NATURAL HISTORY must be welcome to the members of the Museum, as well as its Curators and staff, because the latter now have an outlet for their wealth of artistic and informative material, which was formerly submerged.

For the past year I have been interested in noting, month by month, the remarkable range of subjects treated by your associates in the Museum, in a most artistic and interesting manner and the change is so great that I think it was an entirely overlooked in the old publication, which I may be permitted to say always reminded me of my Grandfather's almanac.

Please keep up the good work. I am sure thousands of members of the American Museum are grateful to you for the great change wrought and let us hope the few scientists holding contrary opinions (as indicated by the letters you have very frankly reprinted) will find solace and their preferred type of brain food in the aforesaid almanac. The American Museum is in many ways the greatest institution of its kind in all the world and I should like to congratulate you upon bringing NATURAL HISTORY Magazine up to the high standard set by its many other branches of endeavor.

FENLEY HUNTER.
Flushing, Long Island.

* * *

Sirs:

Under "Letters" I observe that you solicit the reaction of readers to NATURAL HISTORY. May I say that I find it an excellent magazine which brings pleasure as well as information to all of us. I cannot share the opinion of one of your correspondents that the covers have become "garish" since the adoption of the new

format. In comparing the covers of the older issues with those of the past year I find the general tone and spirit of both quite similar. ERNEST MUTSCHLER.

Forest Hills, L. I.

* * *

Sirs:

I want particularly to compliment NATURAL HISTORY on the effective cover used on the January issue. Mrs. Bostelmann has secured a stunning effect with only three printings. The expression of the animals is particularly good, and is achieved with just a few master strokes....

Sincerely yours,

WM. T. INNES.

Innes Publishing Company,
Philadelphia, Pa.

* * *

Sirs:

Your column "Letters" published each month in NATURAL HISTORY Magazine is highly interesting and instructive and you are to be commended for the production of this feature.

In answer to a letter which you published in the January issue I would make the following comments.

As an Associate Member of the American Museum of Natural History for the past several years and having NATURAL HISTORY Magazine in complete file since 1923, I welcomed the new format for 1937 with much satisfaction. It gives greater scope for the printed article and displays the excellent illustrations to much better advantage.

The cover of each issue is a work of art and the color schemes are wonderfully blended. I have had many complimentary comments from my artist friends here in California on the NATURAL HISTORY Magazine covers for 1937.

The placing of many of the illustrations to cover the margin to the edge of the sheet is highly artistic and truly modernistic. Many other of our higher type magazines are using this technique to set off the illustrated material.

Your departure from the old stereotyped forms used formerly in magazines is a "stroke of genius" and you are to be congratulated on this move.

I subscribe to a geographical magazine published in Europe that has not changed its format for the past fifty years. Is this prosaic tradition of any particular credit to them?

More power to NATURAL HISTORY in the second year of its new and modern format and I feel sure the great majority of the American Museum of Natural History members and readers of NATURAL HISTORY wish you the hearty support and well wishes in your efforts to make the magazine such a valuable and entertaining visitor to our homes. E. B. POWERS.

San Diego, Calif.

* * *

Sirs:

This is just to tell you how greatly my husband and I approve of those changes in NATURAL HISTORY which one of your

correspondents so sternly condemn in the letter which you published in the January number. We are decidedly enthusiastic about the new format and have, since its inception, spoken frequently of how much it has added to the attractiveness of the magazine. I don't understand why your correspondent feels that it detracts from the interest, instructiveness or value of scientific articles to have them published in an attractive form.

Many of your readers, I'm sure, feel, as we do, that the appeal of NATURAL HISTORY has been greatly enhanced by the alterations made. We wish to say "Thank you" to those responsible for giving us a more delightful periodical.

MARIE L. K. WILLISON,
Cincinnati, Ohio.

* * *

With appreciation for the interest shown in the department of Letters, NATURAL HISTORY welcomes further communications as to the type of articles most desired by readers, and will gladly endeavor to answer questions of fact pertaining to subjects published in the magazine.—ED.

Sirs:

... What and where are the largest, smallest and swiftest snakes on record in the United States?

ARTHUR W. EASTON.

Newark, N. J.

* * *

Sirs:

In reply to your inquiry regarding the size and speed of snakes in the United States I can give you the following information:

The longest snakes are probably the Bull Snakes, *Pituophis sayi sayi*, which are known to attain lengths in excess of eight feet. The species inhabits the Middle West, from northern Mexico to Alberta. In actual weight, however, the bull snakes are exceeded by the Eastern Diamond Rattlesnake, *Crotalus adamanteus*, and the Desert Diamond Rattlesnake, *Crotalus cerneatus*, eight-foot records of which have not been well authenticated, although a specimen of the latter weighing 24 pounds recently has been reported.

The smallest indigenous snake appears to be the Desert Worm Snake, *Leptotyphlops humilis cahuilae*, adults of which rarely exceed one foot, and the diameter is hardly three sixteenths of an inch. This snake inhabits the Colorado Desert of California.

The fastest snake in this country which actually has been timed is the Red Racer, *Coluber flagellum frenatum* of the Southwest. It has an average maximum speed of approximately four miles per hour, although a frightened snake in the field would doubtless exceed that speed. There is no reason to believe that eastern, or middlewestern races of the same species are any slower than *frenatum*, and probably the black racer *Coluber piceus* of the extreme Southwest is equally fast. It is believed, incidentally, that the famous Black and Green Mambas of Africa exceed all other snakes in speed.

C. M. BOGERT.

American Museum of Natural History,
New York City.

Continued on page 240

A Sportsman Writes about Hotel Playa de Cortés at Guaymas, MEXICO:

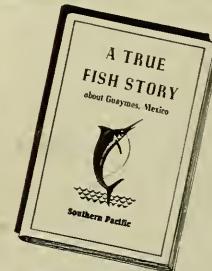
"It is a real top notch hotel . . . I went there from San Francisco with three good friends of mine. Other friends of theirs had been to this place and had come back with the wildest sort of stories about the quantities of marlin swordfish. I took them with a grain of salt and doubted them, although I said nothing. After passing through experiences like this a great many times, you learn to listen to fish stories with a doubt. But now that I have been there and seen the fish myself. I would believe anything they told me about swordfish at this place."



SWORDFISH season at Hotel Playa de Cortés starts in May, but if you don't have to get a swordfish, the fishing is good all year.



SWIM in this magnificent outdoor pool, ride, play tennis or badminton. Golf on a nine hole practice course.



WRITE TODAY for this interesting booklet which describes Hotel Playa de Cortés and tells about the fishing there. Address O. P. Bartlett, Dept. NH-3, 310 So. Michigan Avenue, Chicago, Illinois.

HUNTING trips may be arranged. Lee Brothers of Paradise, Arizona, provide reliable hunting guide service from the Hotel and elsewhere on the West Coast of Mexico.

Southern Pacific's Hotel Playa de Cortés is on the Gulf of California near Guaymas. To get there, take Southern Pacific's luxurious *Sunset Route* (New Orleans-Los Angeles) or *Golden State Route* (Chicago-Los Angeles) trains to Tucson, Arizona, thence to Guaymas by air-conditioned Pullman.

Hotel Playa de Cortés on the West Coast of Mexico

SCIENCE IN THE FIELD AND IN THE LABORATORY— A "Horned" Horse Arrives—Synthetic Emeralds—The George Comer Memorial—Vernay-Kaffrarian Expedition—Photography Contest

Mr. Chubb's "Horned Horse"

For thirty years, Mr. S. Harmsted Chubb* has been trying to get a specimen of a "horned" horse. Last month the quest ended in the city of Brooklyn, and Mr. Chubb was able to announce that his Department of Specialized Osteology would shortly place the long-coveted specimen on exhibition.

Readers of *NATURAL HISTORY* will recall that Mr. Chubb wrote an article last May explaining "horns" in horses as skull deformations. But he had never been able to examine the bone structure of an actual specimen at that time—his conclusions being drawn from his knowledge of what bones will do when crowded together, and on his examination of some 3,000 live horses. Among the horses examined was one belonging to the Borden's Farm Products Company. Officials of that company promised him the head of the animal when it died. And now, through the kindness and thoughtful memory of Mr. Bates and Doctor Hall of Borden's, Museum visitors will be privileged to see the "horned horse" in the Hall of Equine Osteology.

Synthetic Emeralds

Stimulated by nation-wide publicity, curious Museum visitors, as well as excited jewelry tradesmen, have streamed into the Morgan Hall ever since the display of synthetic emeralds presented by the I. G. Farbenindustrie A. B. was opened there on February 1st. While purely of scientific value thus far, the crystals and cut gems were fine in color and successfully passed all tests for natural emeralds (within the customary limits of error in such tests). This was to be expected, since they are identical in structure and composition with naturally formed crystals. In this respect they differ notably from the easily differentiated synthetic rubies.

The emeralds have perfect crystal outlines, showing that they have crystallized from solution, and that the process of manufacture must therefore approximate the natural conditions of formation. The conditions of crystallization have been kept secret by the I. G. Farbenindustrie, but when revealed will be of great importance in the comprehension of geological phenomena. The ability of the makers to control the habit of the crystals, changing at will from groups of crystals to a single larger crystal is also of interest and indicates some of the far-reaching implications of the scientific significance of this commercially sponsored and undoubtedly very expensive research.

*For further details of the work Mr. Chubb has been carrying on at the Museum since 1901, see this month's *Indoor Explorer*.

The George Comer Memorial

Captain Comer, of East Haddam, Connecticut, a man of both strong and lovable character, once commander of the American Museum's Crocker Land Relief Expedition, died last year. In view of his distinguished record as an explorer, the Connecticut State Park Commission has set aside a "George Comer Picnic Area." At this site there is a large boulder in which it is proposed to insert a stone slab with the following inscription:

To the Memory of
Captain George Comer
Able Seaman Arctic Mariner
Navigator of the Seven Seas
1858 1937

Captain Comer obtained much valuable ethnographic material for the American Museum during his several voyages to Hudson's Bay and elsewhere in the North. From islands at the edge of the Antarctic he had previously brought us such natural history specimens as penguins, seals, and the type of the peculiar Gough Island Rail, which the late Dr. J. A. Allen named in his honor *Porphyriornis comeri*.

Because of this relationship, and because of the Captain's close personal association with the staff and many members of the Museum, the administration has given its hearty support to the memorial. Dr. Robert Cushman Murphy has been requested to accept contributions, which may be given in cash or drawn as checks to his order.

The total sum required for the memorial slab is \$100.00. If, however, this amount should be exceeded, the surplus would be used for landscaping improvements at the site.

Vernay-Kaffrarian African Expedition

Recognizing the need for a mammal collection from the upper Zambezi in the western part of Northern Rhodesia, Mr. Arthur S. Vernay has made possible an expedition to this region which will be led by Captain Guy S. Shortridge, Director of the Kaffrarian Museum. Accompanying Captain Shortridge are Mr. T. Donald Carter, this Museum's Assistant Curator of Mammals, and Mr. Cary Grayson, Jr., who is interested in Botanical research.

The expedition will first go to King William's Town and will collect specimens in the eastern Cape Province. Captain Shortridge and Mr. Carter will then proceed to the Upper Zambezi region and probably continue on over the border into northwest Angola. Mr. Grayson will return when he has finished his research in the eastern Cape Province.

International Photographic Exhibit

The International Salon of Photography will again hold its annual exhibit in Education Hall of the American Museum from April 13-28. Readers of *NATURAL HISTORY* will remember last year's exhibit and the reproduction in this magazine of some of its outstanding photographs of natural history subjects.

This year, Mr. Emanuel Weil, Secretary of the Pictorial Photographers of America, which is sponsoring the International Salon, has announced that there is to be a special section for Natural History photographs. In the belief that our readers may be interested in submitting entries for this or any other section of the exhibit, it is announced that photographs will be received for consideration up to March 15th. An entrance fee of \$1.00 is charged for each set of four entries in any or all of the following five sections (20 pictures may be submitted for this sum):

1. Pictorial or Conservative Artistic Photography
2. Modern Photography
3. Professional or Illustrative Photography
4. Press and News Photography
5. Natural History and Scientific Photography

The photographs selected by the judges as best in each category will be exhibited, and honorary awards will be granted by the committee to outstanding examples.

Entrance forms may be secured by writing to The Pictorial Photographers of America, c/o The American Museum of Natural History, or to Mr. Emanuel Weil, 100 Gold Street, New York City. Photographs must not be sent to *NATURAL HISTORY* Magazine, but to Mr. Weil.

Amateur Astronomers Association

Meetings of the Amateur Astronomers Association on Wednesdays in the Roosevelt Memorial Building, and of the Junior Astronomy Club on Saturdays in the same place continue as follows:

March 5—Dr. Robert I. Wolff, Assistant Professor of the College of the City of New York—"Astronomical Photography."

March 19—Earle Brown—"Statistics—

Key to the Cosmos."

Each meeting of the Amateur Astronomers Association for the rest of this season is preceded by one of the preliminary contests in its first Astronomical Question Bee. Thirty members of the Association are competing for prizes, to be presented at the close of the annual meeting in May to the winner in the contest. The Question Bee is conducted orally, and all persons interested in hearing it are invited to attend.

Continued on page 240

THE ENIGMA OF THE SQUAW-MAN —Continued from page 189

really known them they would have expressed resentment over the conventionally closed doors leading to the fireside of their fathers' people, but I doubt it. Surely nothing came to my eye or ear even hinting of such a thing.

As to their brothers, well, one was inclined to agree with the major, for to see some of them was enough to make you feel for your pocketbook. I can see one of them yet, a burly prize-fighting appearance, a bloated face, silk handkerchief around his neck, demanding the loan of five dollars on the ground that we owed the Indians something for coming on their land. Finding that I was neither frightened nor impressed, he asked for liquor, finally begging for a quarter, saying that he was a white man and that surely I would help a white brother. Fortunately, all were not like this, far from it.

Lest the picture be painted too black, let us turn to an exceptional case or two. About the second day on a certain reservation I was introduced to Cloud, obviously half-white and in command of good terse English. A check-book and a diary protruding from his pocket guaranteed that he was literate and business-like. One of his first moves was to try to sell me a horse or two: "Got too many horses, you know. Got to sell some of them, eat up all the grass, you know." Receiving no encouragement he soon dropped the matter. Gradually I came to know and admire this man, though I had no desire to trade with him.

Upon inquiry I learned that his father had been a trader, but that from the white point of view Cloud was illegitimate. However, I was warned never to hint as much, for in times past Cloud had knocked out more than one white man for saying something he interpreted as an insult to his Indian mother. Ultimately I saw her, a very old but magnificent full-blood woman. It was an inspiration to look at her. That she adored her son was obvious, and it was equally clear that Cloud saw to it that she had the comforts of Indian life as she knew them—"Nothing too good for the Old Mother," he said.

A man without a race

You should have seen his home, a large two-story frame house, with a lawn, a kind of garden with a small lake in which there were real swans. Did the Old Mother live in this great house? Yes, she had a room there all her own, but at the far side of the garden, where one could look out upon the virgin hills, was a fine skin-covered tipi in which she spent much of her time around a fire of cottonwood bark. When I commented upon this, Cloud said, "Can't stand too much civilization, you know."

When I met Cloud's wife, the mistress of this house, I found her a full-blood, but intelligent and efficient. To all appearances she lived like a white woman and preferred a brass bed to a pallet in a tipi. The reader who has scanned these pages need not be told how Cloud made his money; cattle, horses, contracting with the government, etc., but in his case it

was legal, except possibly when he bribed an official. His house was always full of Indian relatives and hangers-on, but he could afford the usual Indian hospitality. His children and grandchildren were nothing to be proud of, lazy and snobbish, none of them showing much promise to carry on.

Perhaps the reader is aglow with approval for this seemingly successful career; but in time, as we came nearer to Cloud's inner life, it became clear that the outlook for him was not altogether alluring. He seemed not to lack confidence in his business ability, but he was lonely, very lonely in spirit. His white associates could not forget that he was a "breed." None of them would take him by the hand and say, "You are a man"; no one ever made him feel quite welcome. At times we suspected that his eternal bustle at business was an attempt to smash down these barriers.

Cloud's decline

Now and then he sought an outlet in another direction, a grand drunk. We felt that already Cloud had passed the high point in his career, that he was on the down grade. Year after year his herds decreased, his house and grounds fell into disorder, his wife died, he turned the place over to his children. He drank more and more, and eventually died.

The major said, "I told you so. The eternal breed dominated in the end." It was hard to accept this statement, for many a white man has done the same thing outwardly at least. But it must be admitted that Cloud was handicapped, for "breed" he was. That, he could not forget; nor did those among whom he lived forget it. We should have liked to inscribe over his tomb, "He had no place to go."

Then we recall Sunray, who was once my guide. He also had a white father whose memory he cherished as a successful gambler, a career he secretly envied but could not follow. Sunray was bright, had done fairly well in an Indian boarding school, and learned to make harness, a trade which gave him part-time employment around the agency. But he really enjoyed taking me about and took an intelligent interest in helping me with my notes. Often around the camp-fire he opened his mind. He saw no future in his trade. What galled him most was that no one trusted him. He was loyal to me but I heard that he was tricky at times and grasping. His favorite game was to over-charge for his services. When I parted from him the last time, he seemed melancholy.

"You are a white man," he said. "You have a place among your people, you count for something. Around us here are Indians, they revere their past, they have the respect of their fellows. Here am I, neither an Indian nor a white man—just nothing."

I did what I could to encourage him, to suggest that he could be a white man if he set out to be, though I had secret misgivings about the soundness of this advice. We parted and Sunray returned to his job. But a year or two later he blew out his brains. Poor Sunray! Our ethical code frowns upon such a deed, but

there always rises the question: What else could he do?

Enough of such depressing scenes. There were many who did live it out—average resistant souls. Here again we are looking back at the long ago, for life on a reservation today is quite a different matter. Most everywhere the mixed-bloods constitute a respectable minority and so have social solidarity. Statistics show that they are healthier, have a higher birth rate and a lower death rate than full-bloods. Also, in standard of living, schooling, church affiliation, etc., they lead. In short they have found a place in the world and deserve our respect.

THE MYSTERY DINOSAUR

Continued from page 262

mine. Supporting timbers were then placed in the chamber above and the blocks were lowered successively with a five-ton block and tackle.

Even after the block was sectioned some parts of the mine had to be re-timbered so that the sections could pass through. Finally, out of the mine they were still further reduced until the three weighed only eight tons as crated, after which they were hauled 200 miles by truck and loaded into the car with the Rock Spring collection—a fitting conclusion to a successful season's work.

The coal measures of western Colorado are not so thick as in the Rock Springs region and are timber covered, with steeper exposures, and are therefore not so favorable for bone hunters, but in the nearby Green Valley Mine we secured a large Trachodont humerus with other fragmentary bones similar to our largest specimen, and from surface exposures a large Ceratopsian horn core similar to those found at Rock Springs.

An abandoned, much caved room in the same mine was known during its operation as the "tropical room" on account of the beautiful palm leaves that covered the roof. One magnificent specimen still remained, precariously hanging with tons of loose rock above it. It was irresistible to fossil hunters, and Bird and Ryan remained (while the tracks were in transit by truck), to re-timber this room and cut it down, thus adding an unusually perfect specimen to a magnificent series of plants.

Always buoyed with the hope of finding the giant who made the enormous tracks, we traveled far beyond the better known exposures of the Mesaverde formation, finding only a single bone—an incomplete humerus—that can be attributed to this type of Iguanodont dinosaur. However, other extensive exposures of this same age were located where there is little coal and few plant remains, and we hope another season's intensive search will be rewarded by a skeleton of the elusive monster of the giant footprints.

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Who · When · Where

THE CALENDAR OF ENTERTAINMENT

Believing that many readers of NATURAL HISTORY may wish to know about the amazingly varied opportunities for cultural entertainment offered by the American Museum and other neighboring institutions, this monthly calendar of events is instituted as a regular feature of each issue. We hope that it will serve not only as a guide but as an inspiration to educational planning.

CHARLES RUSSELL,

*Curator of the Department of Education,
American Museum of Natural History*

MARCH 1

AMERICAN MUSEUM OF NATURAL HISTORY

3:50 p. m.—Lecture—"Instinct or Intelligence?"—Dr. A. L. Melander—Museum Auditorium—Open to Public.
8:15 p. m.—Lecture—"Know Your Museum Series: The Oceans as the Theater of Life"—Dr. Roy W. Miner—Lecture Room Roosevelt Memorial—Open to Members.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Color in Peasant Art"—Miss Cornell—Meeting Place: Classroom K—Open to Public.
12:00 p. m.—Tour of Collection—The Collection of Armor—Meeting Place: Main Hall—Open to Public.
2:30 p. m.—Motion Picture—"A Visit to the Armor Galleries; Behind the Scenes in the Metropolitan Museum"—Lecture Hall—Open to Public.
3:00 p. m.—Lecture—"Design in the Decorative Arts: Rhythm and Pattern"—Miss Cornell—Meeting Place: Classroom K—Open to Public.
4:00 p. m.—Lecture—"Pottery and Carving of the T'ang Dynasty"—Miss Duncan—Meeting Place: Main Hall—Open to Public.

MARCH 2

AMERICAN MUSEUM OF NATURAL HISTORY

11:00 a. m. and 3:00 p. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial—Open to Public.
3:30 p. m.—Radio Broadcast—"Music of the Spheres"—Marian Lockwood—Station WQXR.
4:10 p. m.—Lecture—"Life Histories of Mammals"—Mr. Goodwin—Open to Members.

BROOKLYN MUSEUM

3:45 p. m.—Correlated Concert—"England and Ireland"—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Caffieri, Clodion, and Falconet"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Materials of the Craftsman: Glass, Blown, Gilded, and Enamelled Types"—Miss Bradish—Meeting Place: Main Hall—Open to Public.
2:00 p. m.—Tour of Collections—Oriental Art: The Far East—Meeting Place: Main Hall—Open to Public.
4:00 p. m.—Lecture—"The Gothic Age in Italy and Germany: The Towns and the Tyrants"—Leopold Arnould—Lecture Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

3:30 p. m.—Motion Picture—"Construction of George Washington Bridge"—Open to Public.

MARCH 3

AMERICAN MUSEUM OF NATURAL HISTORY

11:30 a. m.—Radio Broadcast—"Museum Reporter: Niagara's Story"—John R. Saunders—Station WHN.

FRICK COLLECTION

3:00 p. m.—Lecture—"Thomas Gainsborough"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"The Art of Flanders: Two Great Flemish Landscapes"—Mrs. Fansler—Meeting Place: Main Hall—Open to Public.

2:00 p. m.—Tour of Galleries—European Decorative Arts—Meeting Place: Main Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

3:30 p. m.—Lecture—"Revolutionary New York"—Aileen G. Barlow—Open to Public.

MARCH 4

AMERICAN MUSEUM OF NATURAL HISTORY

11:00 a. m. and 3:00 p. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial—Open to Public.

BROOKLYN BOTANIC GARDEN

3:15 p. m.—Radio Broadcast—"Plant Explorers"—Charles F. Doney—Station WNYC.

BROOKLYN MUSEUM

4:00 p. m.—Lecture—"Renaissance Painting in Brooklyn Museum"—John L. H. Baur—Classroom A—Admission 25¢.

FRICK COLLECTION

3:00 p. m.—Lecture—"Dutch Painting in the Collection"—Open to Public.

MARCH 5

AMERICAN MUSEUM OF NATURAL HISTORY

10:30 a. m.—Lecture—"Children of Mexico"—Mrs. Gladys Pratt—Open to Children of Members.

11:00 a. m. and 3:00 p. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial—Open to Public.

12:15 p. m.—Radio Broadcast—"This Wonderful World"—Question and Answer Program by Museum Visitors—Station WOR.

2:00 p. m.—Motion Picture—"Hopi Indians of the Southwest"—Museum Auditorium—Open to the Public.

BROOKLYN MUSEUM

3:00 p. m.—Dance Recital—Jane Dudley and Sophie Maslow—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Degas and Toulouse-Lautrec"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Greek Art and Civilization: Greek Colonial Expansion"—Mr. Shaw—Lecture Hall—Open to Public.

2:00 p. m.—Gallery Talks—"Rococo Furniture in Europe"—Mr. Busselle—Meeting Place: Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"Digging into the Past; The Daily Life of the Egyptians—Ancient and Modern"—Lecture Hall—Open to Public.

3:00 p.m.—Lectures for the Deafened Who Read the Lips—"Jewels of an Egyptian Princess"—Jane B. Walker—Classroom B—Open to Public.

4:00 p.m.—Lecture—"Social Aspects of Art: The Renaissance"—Julius S. Held, Barnard College—Lecture Hall—Open to Public.

8:00 p.m.—Symphony Concert—Directed by David Mannes—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

1:15 p.m.—Motion Picture—"Feeding New York"—Open to Public.

NEW YORK BOTANICAL GARDEN

3:00 p.m.—Lecture—"Plants in the Modern City"—Nelson M. Wells—Open to Public.

MARCH 6

FRICK COLLECTION

3:00 p.m.—Lecture—"The Development of American Taste in Art"—Phillip Newell Youtz—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p.m.—Tour of Collections—Modern Art—Mr. Shaw—Meeting Place: Main Hall—Open to Public.

2:30 p.m.—Motion Picture—"Tapestries and How They Are Made; the Making of a Stained Glass Window"—Lecture Hall—Open to Public.

2:30 p.m.—Lecture—"Rococo Furniture in Europe"—Mr. Busselle—Meeting Place: Main Hall—Open to Public.

3:00 p.m.—Lecture—"Color Study: Near Eastern Art"—Miss Cornell—Classroom K—Open to Public.

3:15 p.m.—Tour of Collections—Archaic Greek Art—Mr. Shaw—Meeting Place: Main Hall—Open to Public.

4:00 p.m.—Lecture—"The Academic Idea in Art"—Royal Cortissoz—Lecture Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

4:00 p.m.—Lecture—"Broadway"—J. B. Vandevere—Open to Public.

MARCH 7

AMERICAN MUSEUM OF NATURAL HISTORY

4:30 p.m.—Radio Broadcast—"Today's Natural History"—Robert R. Coles—Station WNYC.

6:00 p.m.—Radio Broadcast—"New Horizons Series—'Animals as Artist's Models'"—Charles R. Knight—Columbia Broadcasting System (Coast to Coast network).

MARCH 8

AMERICAN MUSEUM OF NATURAL HISTORY

3:50 p.m.—Motion Picture—"Sequoia"—Museum Auditorium—Open to Public.

METROPOLITAN MUSEUM OF ART

1:00 a.m.—Lecture—"Color in Chinese Porcelain"—Miss Cornell—Meeting Place: Classroom K—Open to Public.

12:00 m.—Tour of Collections—The American Wing—Meeting Place: Main Hall—Open to Public.

2:30 p.m.—Motion Picture—"The Pottery Maker: the American Wing"—Lecture Hall—Open to Public.

3:00 p.m.—Lecture—"Design in Decorative Fabrics"—Miss Cornell—Classroom K—Open to Public.

4:00 p.m.—Lecture—"Painting and Poetry of the T'ang Dynasty"—Miss Duncan—Meeting Place: Main Hall—Open to Public.

MARCH 9

AMERICAN MUSEUM OF NATURAL HISTORY

11:00 a.m. and 3:00 p.m.—Guide Service—Meeting Place: 2nd Floor

MUSEUM OF THE CITY OF NEW YORK

3:30 p.m.—Motion Picture—"Old-Time Movies"—Lillian Russell, Theodore Roosevelt, etc.)—Open to Public.

MARCH 10

AMERICAN MUSEUM OF NATURAL HISTORY

1:15 a.m.—Radio Broadcast—"Museum Reporter: The Grand Canyon"—John R. Saunders—Station WHN.

8:15 p.m.—Lecture—"The Search for the Congo Peacock"—Dr. James P. Chapin—Open to Members.

FRICK COLLECTION

3:00 p.m.—Lecture—"Italian Painting in the Collection"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a.m.—Lecture—"The Art of Flanders: Peter Paul Rubens"—Mrs. Fansler—Meeting Place: Main Hall—Open to Public.

2:00 p.m.—Tour of Collections—The Egyptian Collection—Meeting Place: Main Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

3:30 p.m.—Lecture—"From Ox-Cart to Motor Car"—Aileen G. Barlow—Open to Public.

MARCH 11

AMERICAN MUSEUM OF NATURAL HISTORY

11:00 a.m. and 3:00 p.m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial Building—Open to Public.

BROOKLYN MUSEUM

4:00 p.m.—Lecture—"Figure Composition in Dance, Painting and Sculpture"—Grant H. Code—Classroom A—Admission 25¢.

FRICK COLLECTION

3:00 p.m.—Lecture—"Eighteenth Century French Paintings in the Collection"—Open to Public.

MARCH 12

AMERICAN MUSEUM OF NATURAL HISTORY

10:30 a.m.—Motion Picture—"Exploring the Antarctic"—Museum Auditorium—Open to Public.

11:00 a.m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial Building—Open to Public.

12:15 p.m.—Radio Broadcast—"This Wonderful World"—Question and Answer Program by Museum Visitors—Station WOR.

2:00 p.m.—Motion Picture—"The Silent Enemy"—Museum Auditorium—Open to Public.

3:00 p.m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial Building—Open to Public.

BROOKLYN MUSEUM

3:00 p.m.—Dance Recital—Saki—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p.m.—Lecture—"Italian Sculpture in the Collection"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Greek Art and Civilization—The Period of Oriental Influence"—Mr. Shaw—Lecture Hall—Open to Public.

2:00 p. m.—Lecture—"American Furniture (1750-1775)"—Mr. Busselle—Meeting Place: Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"The Etcher's Art; Drypoint—a Demonstration"—Lecture Hall—Open to Public.

4:00 p. m.—Lecture—"Social Aspects of Art: The Present"—John Alford, University of Toronto—Lecture Hall—Open to Public.

8:15 p. m.—Symphony Concert—Directed by David Mannes—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

1:15 p. m.—Motion Picture—"New Frontiers"—Open to Public.

3:00 p. m.—Lecture—"Federal Period"—Lydia Miller—Open to Public.

NEW YORK BOTANICAL GARDEN

3:00 p. m.—Lecture—"Bulbs in the Rock Garden"—Ethel Anson S. Peckham—Open to Public.

MARCH 13

FRICK COLLECTION

3:00 p. m.—Lecture—"Dutch Painting in the Collection"—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Tour of Collections—Greek Sculpture—Mr. Shaw—Meeting Place: Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"The Temples and Tombs of Ancient Egypt; The Making of a Bronze Statue"—Lecture Hall—Open to Public.

2:30 p. m.—Lecture—"American Furniture (1750-1775)"—Mr. Busselle—Meeting Place: Main Hall—Open to Public.

3:00 p. m.—Lecture—"Color and Design in Near Eastern Textiles"—Maurice S. Dimand—Classroom K—Open to Public.

3:15 p. m.—Tour of Collections—Greek Arts of the V and IV Centuries—Mr. Shaw—Meeting Place: Main Hall—Open to Public.

4:00 p. m.—Lecture—"The Individualistic Idea in Art"—Royal Cortissoz—Lecture Hall—Open to Public.

MARCH 14

AMERICAN MUSEUM OF NATURAL HISTORY

4:30 p. m.—Radio Broadcast—"Today's Natural History"—Robert R. Coles—Station WNYC.

6:05 p. m.—Radio Broadcast—New Horizons Series—"Romance of the Gems"—Herbert P. Whitlock—Columbia Broadcasting System—(Coast to Coast Network).

MARCH 15

AMERICAN MUSEUM OF NATURAL HISTORY

3:50 p. m.—Lecture "To Africa for Its First Pheasant"—Dr. James P.

Chapin—Musuem Auditorium—Open to Public.

8:15 p. m.—Lecture—"Know Your Museum Series: The Oceanic Shelf and Its Significance"—Dr. Roy W. Miner—Roosevelt Memorial Lecture Room—Open to Members.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Color in English Chinaware"—Miss Cornell—Classroom K—Open to Public.

12:00 m.—Tour of Collections—The Collection of Greek Art—Meeting Place: Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"Fire-arms of Our Forefathers; Frontier Woman"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Design in the Decorative Arts: Design in Rugs"—Miss Cornell—Classroom K—Open to Public.

4:00 p. m.—Lecture—"The Sung Dynasty, North and South"—Miss Duncan—Meeting Place: Main Hall—Open to Public.

MARCH 16

AMERICAN MUSEUM OF NATURAL HISTORY

11:00 a. m. and 3:00 p. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial Building—Open to Public.

3:30 p. m.—Radio Broadcast—"Music of the Spheres"—Marian Lockwood—Station WQXR.

4:10 p. m.—Lecture—"Families of Insects"—Dr. C. H. Curran—Open to Members.

BROOKLYN MUSEUM

3:45 p. m.—Correlated Concert—"Sweden, Norway and Denmark"—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Furniture in the Collection"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Glass: Cut and Pressed Mold Types"—Miss Bradish—Meeting Place: Main Hall—Open to Public.

2:00 p. m.—Tour of Collections—The Medieval Collection—Meeting Place: Main Hall—Open to Public.

4:00 p. m.—Lecture—"The Gothic Age in Italy and Germany: Municipal Buildings and the Guild"—Leopold Arnaud—Lecture Hall—Open to Public.

MARCH 17

AMERICAN MUSEUM OF NATURAL HISTORY

11:30 a. m.—Radio Broadcast—"Museum Reporter: Iron"—John R. Saunders—Station WHN.

FRICK COLLECTION

3:00 p. m.—Lecture—"Nineteenth Century French Painting in the Collection"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"The Art of Flanders: The Development of Rubens' Style"—Mrs. Fansler—Meet-

ing Place: Main Hall—Open to Public.

2:00 p. m.—Tour of Collection—Oriental Art: the Near East—Meeting Place: Main Hall—Open to Public.

MARCH 18

AMERICAN MUSEUM OF NATURAL HISTORY

11:00 a. m. & 3:00 p. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial Hall—Open to Public.

BROOKLYN BOTANIC GARDEN

2:15 p. m.—Radio Broadcast—"The International Flower Show: A Panorama"—Montagu Free—Station WOR.

3:15 p. m.—Radio Broadcast—"Plant Explorers"—C. F. Doney—Station WNYC.

BROOKLYN MUSEUM

4:00 p. m.—Lecture—"Why and When Photography Is an Art"—Herman De Wetter—Classroom A—Admission 25¢.

FRICK COLLECTION

3:00 p. m.—Lecture—"Chinese Porcelains in the Collection"—Open to Public.

MARCH 19

AMERICAN MUSEUM OF NATURAL HISTORY

10:00 a. m.—Lecture—"Strange Doings in Beaverland"—Grey Owl—Open to children of Members.

11:00 a. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial—Open to Public.

12:15 p. m.—Radio Broadcast—"This Wonderful World"—Question and Answer Program by Museum Visitors—Station WOR.

2:00 p. m.—Motion Picture—"Simba"—Museum Auditorium—Open to Public.

3:00 p. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial—Open to Public.

BROOKLYN MUSEUM

3:00 p. m.—Dance Recital—Novikoff Russian American Ballet—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Spanish Paintings in the Collection"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Greek Art and Civilization: Archaic Art of the VI Century"—Mr. Shaw—Lecture Hall—Open to Public.

2:00 p. m.—Lecture—"The Inheritance from XVIII Century French Painting"—Mr. Busselle—Meeting Place: Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"A Visit to the Armor Galleries; Drypoint—a Demonstration"—Lecture Hall—Open to Public.

4:00 p. m.—Lecture—"New Theories Regarding the Athenian Acropolis"

—William B. Dinsmoor, Columbia University—Lecture Hall—Open to Public.

8:30 p. m.—Symphony Concert—Directed by David Mannes—Open to Public.

NEW YORK BOTANICAL GARDEN

3:30 p. m.—Lecture—"The Miracle of Seeds"—Jessie G. Fiske—Open to Public.

MARCH 20

FRICK COLLECTION

3:30 p. m.—Lecture—"The Relation of Chardin and Greuze to the Philosophers"—John M. S. Allison, Yale University—Open to Public.

METROPOLITAN MUSEUM OF ART

2:30 p. m.—Tour of Collections—Roman Decorative Arts—Mr. Shaw—Meeting Place: Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"The Making of Wrought Iron; The American Wing"—Lecture Hall—Open to Public.

2:30 p. m.—Lecture—"The Inheritance from XVIII Century French Painting"—Mr. Busselle—Meeting Place: Main Hall—Open to Public.

3:30 p. m.—Lecture—"Color Study: Far Eastern Art"—Miss Cornell—Classroom K—Open to Public.

3:30 p. m.—Tour of Collections—Roman Portraiture—Mr. Shaw—Meeting Place: Main Hall—Open to Public.

4:00 p. m.—Lecture—"Dutch Daily Life in Old Dutch Pictures"—Wilhelm Martin—Lecture Hall—Open to Public.

MARCH 21

AMERICAN MUSEUM OF NATURAL HISTORY

4:30 p. m.—Radio Broadcast—"Today's Natural History"—Robert R. Coles—Station WNYC.

6:05 p. m.—Radio Broadcast—"New Horizons Series"—Columbia Broadcasting System—(Coast to Coast Network).

MARCH 22

AMERICAN MUSEUM OF NATURAL HISTORY

3:30 p. m.—Motion Picture—"The Bottom of the World"—Museum Auditorium—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Color in French Chinaware"—Miss Cornell—Classroom K—Open to Public.

12:00 m.—Tour of Collections—European Decorative Arts—Meeting Place: Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"The Temples and Tombs of Ancient Egypt; The Making of a Bronze Statue"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Design in Wall Coverings"—Miss Cornell—Classroom K—Open to Public.

4:00 p. m.—Lecture—"Genghis Khan's Invasion"—Miss Duncan—Meeting Place: Main Hall—Open to Public.

MARCH 23

AMERICAN MUSEUM OF NATURAL HISTORY

11:00 a. m. & 3:00 p. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial—Open to Public.

3:30 p. m.—Radio Broadcast—"Music of the Spheres"—Marian Lockwood—Station WQXR.

4:10 p. m.—Lecture—"Birds of Our Parks"—Miss Wiley—Open to Members.

FRICK COLLECTION

3:00 p. m.—Lecture—"Limoges Enamels in the Collection"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Metals: Bronze"—Miss Bradish—Meeting Place: Main Hall—Open to Public.

2:00 p. m.—Tour of the Collections—The Collection of Paintings—Meeting Place: Main Hall—Open to Public.

4:00 p. m.—Lecture—"Characteristics of German Gothic Architecture"—Leopold Arnaud—Lecture Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

3:30 p. m.—Motion Picture—"Life of George Washington"—Open to Public.

MARCH 24

AMERICAN MUSEUM OF NATURAL HISTORY

11:30 a. m.—Radio Broadcast—"Museum Reporter: Quartz"—John R. Saunders—Station WHN.

8:15 p. m.—Lecture—"Peregrines of Perce"—Cleveland P. Grant—Open to Members.

FRICK COLLECTION

3:00 p. m.—Lecture—"Dutch Painting in the Collection"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Paintings by Rubens in the Metropolitan Museum"—Mrs. Fansler—Meeting Place: Main Hall—Open to Public.

2:00 p. m.—Tour of Collections—The American Wing—Meeting Place: Main Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

3:30 p. m.—Lecture—"Colonial Costumes"—Aileen G. Barlow—Open to Public.

MARCH 25

AMERICAN MUSEUM OF NATURAL HISTORY

11:00 a. m. & 3:00 p. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial—Open to Public.

BROOKLYN MUSEUM

4:00 p. m.—Lecture—"French Influence on American Art"—John I. H. Baur—Classroom A—Admission 25¢.

FRICK COLLECTION

3:00 p. m.—Lecture—"William Hogarth"—Open to Public.

MARCH 26

AMERICAN MUSEUM OF NATURAL HISTORY

10:30 a. m.—Motion Picture—"To the Galapagos Islands"—Museum Auditorium—Open to Public.

11:00 a. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial—Open to Public.

12:15 p. m.—Radio Broadcast—"This Wonderful World"—Question and Answer Program by Museum visitors—Station WOR.

2:00 p. m.—Motion Picture—"Alaska"—Museum Auditorium—Open to Public.

3:00 p. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial—Open to Public.

BROOKLYN MUSEUM

3:00 p. m.—Dance Recital—Eduard Do Buron—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Jan Vermeer of Delft"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Sculpture and Painting of the V Century"—Mr. Shaw—Lecture Hall—Open to Public.

2:00 p. m.—Lecture—"Romantic and Classic Types of French Painting"—Mr. Busselle—Meeting Place: Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"The Potter's Maker; The Making of a Stained-Glass Window"—Lecture Hall—Open to Public.

4:00 p. m.—Lecture—"Wasiti, a XIII Century Painter in Baghdad"—Eustache de Lorey, Ecole du Louvre, Paris—Lecture Hall—Open to Public.

8:00 p. m.—Symphony Concert—Directed by David Mannes—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

11:15 p. m.—Motion Picture—"Conquest of the Hudson"—Open to Public.

NEW YORK BOTANICAL GARDEN

3:00 p. m.—Lecture—"Edible Mushrooms and How They Grow"—William S. Thomas—Open to Public.

MARCH 27

FRICK COLLECTION

3:00 p. m.—Lecture—"Duccio and the Altarpiece for Siena Cathedral"—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Tour of Collections—Early Christian and Byzantine Art—Mr. Grier—Meeting Place: Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"Digging into the Past; The Daily Life of the Egyptians—Ancient and Modern"—Lecture Hall—Open to Public.

2:30 p. m.—Lecture—"Romantic and Classic Types of French Painting"—Mr. Busselle—Meeting Place: Main Hall—Open to Public.

3:00 p. m.—Lecture—"Far Eastern Costume"—Pauline Simmons—Classroom K—Open to Public.
3:15 p. m.—Tour of Collections—Romanesque and Early Gothic Art—Mr. Grier—Meeting Place: Main Hall—Open to Public.
4:00 p. m.—Lecture—"The Cloisters in Fort Tryon Park"—James J. Rorimer—Lecture Hall—Open to Public.

MARCH 28

AMERICAN MUSEUM OF NATURAL HISTORY

4:30 p. m.—Radio Broadcast—"Today's Natural History"—Robert R. Coles—Station WNYC.
6:05 p. m.—Radio Broadcast—New Horizons Series: "Natural History Anecdotes"—Dr. Edward M. Weyer, Editor NATURAL HISTORY—Columbia Broadcasting System (Coast to Coast Network).

MARCH 29

AMERICAN MUSEUM OF NATURAL HISTORY

3:50 p. m.—Lecture—"Collecting Chameleons in Cuba"—Dr. G. Kingsley Noble—Museum Auditorium—Open to Public.
8:15 p. m.—Lecture—"Know Your Museum Series: Coral Reefs of Tropic Seas"—Dr. Roy W. Miner—Roosevelt Memorial Lecture Room—Open to Members.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Color in Dress Fabrics"—Miss Cornell—Classroom K—Open to Public.
12:00 m.—Tour of Collections—The Egyptian Collection—Meeting Place: Main Hall—Open to Public.
2:30—Motion Picture—"Drypoint—a Demonstration; The Etcher's Art"—Lecture Hall—Open to Public.
3:00 p. m.—Lecture—"Design in Wood"—Miss Cornell—Classroom K—Open to Public.
4:00 p. m.—Lecture—"The Ming Emperors"—Miss Duncan—Meeting Place: Main Hall—Open to Public.

MARCH 30

AMERICAN MUSEUM OF NATURAL HISTORY

11:00 a. m. & 3:00 p. m.—Guide Service—Meeting Place: 2nd Floor Roosevelt Memorial—Open to Public.
3:30 p. m.—Radio Broadcast—"Music of the Spheres"—Marian Lockwood—Station WQXR.
4:10 p. m.—Lecture—"The Moon and the Planets"—Dorothy Bennett—Open to Members.

FRICK COLLECTION

3:00 p. m.—Lecture—"Giovanni Bellini and the Frick St. Francis"—Open to the Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Metals: Gold"—Miss Bradish—Meeting Place: Main Hall—Open to Public.

2:00 p. m.—Tour of Collections—The Collection of Roman Art—Meeting Place: Main Hall—Open to Public.
4:00 p. m.—Lecture—"The Lombard Kinship—German Influence in Italy"—Leopold Arnaud—Lecture Hall—Open to Public.

MARCH 31

AMERICAN MUSEUM OF NATURAL HISTORY

11:30 a. m.—Radio Broadcast—"Museum Reporter: Precious Stones"—

AMERICAN MUSEUM OF NATURAL HISTORY

Central Park West at 79th Street, New York City

Hours: Daily 9:00 a. m. to 5:00 p. m.
Sunday 1:00 p. m. to 5:00 p. m.
Admission Free.

BROOKLYN BOTANIC GARDEN

1000 Washington Avenue, Brooklyn

Hours: Daily from 9:00 a. m. until dark.
Sundays from 10:00 a. m.
Conservatories open from 10:00 a. m. until 4:00 p. m.
Admission Free.

BROOKLYN MUSEUM

Eastern Parkway and Washington Avenue, Brooklyn

Hours: Daily 10:00 a. m. to 5:00 p. m.
Saturdays and holidays 10:00 a. m. to 6:00 p. m.
Sundays 2:00 p. m. to 6:00 p. m.
Admission free, except Mondays and Fridays, when charge is 25¢ for adults and 10¢ for children.

FRICK COLLECTION

1 East 70th Street, New York City

SCIENCE IN THE FIELD AND IN THE LABORATORY

—Continued from page 234

Live Habitat Group

Combining the features of a well-maintained zoo and an attractive museum habitat group, a new exhibit has been installed in the basement of the Roosevelt Memorial Building at the American Museum. Here, against some artificial plants and a painted background, living specimens of box turtles, spotted turtles, garter snakes and leopard frogs move about or gaze at the visitor. They represent a slice of Long Island's wild life.

Honors and Awards

Last month the degree of Doctor of Philosophy was conferred on Mrs. Grace Fisher Ramsey of the Museum's Education Department by New York University. Her thesis, the product of 6 years' work, was "The Development, Methods, and Trends of Educational Work in Museums of the United States," to secure data for which Doctor Ramsey studied 248 of the largest museums in the country, observing therein educational work in art, history, and science.

John R. Saunders—Station WHN.

FRICK COLLECTION

3:00 p. m.—Lecture—"Sir Joshua Reynolds"—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Adriaen Bouwer"—Mrs. Fansler—Meeting Place: Main Hall—Open to Public.

2:00 p. m.—Tour of Collections—The Mediaeval Collection—Meeting Place: Main Hall—Open to Public.

Hours: Weekdays 10:00 a. m. to 5:00 p. m.
Admission Free.

METROPOLITAN MUSEUM OF ART

Fifth Avenue and 82nd Street, New York City

Hours: Daily 10:00 a. m. to 5:00 p. m.
Saturdays and holidays 10:00 a. m. to 5:00 p. m.
Sundays 1:00 p. m. to 5:00 p. m.
Admission free, except Mondays and Fridays, when charge is 25¢.

MUSEUM OF THE CITY OF NEW YORK

Fifth Avenue and 103rd Street, New York City

Hours: Daily 10:00 a. m. to 5:00 p. m.
Saturdays and holidays 10:00 a. m. to 6:00 p. m.
Sundays 1:00 p. m. to 6:00 p. m.
Closed Tuesdays.
Admission free, except Monday, when charge is 25¢.

NEW YORK BOTANICAL GARDEN

Bronx Park, Bronx, N. Y.

Hours: Museum and Conservatories open daily 10:00 a. m. to 4:30 p. m.
Admission Free.

LETTERS—Continued from page 233

Sirs:

I read with interest the article with reference to South African succulents in the February issue of NATURAL HISTORY.

We enjoy unusual plants and I would appreciate information as to where I may secure some. Or can you tell me if it is permissible to import these plants?

WALLACE C. HUTTON.

New Haven, Conn.

* * *

Sir:

Repeating this inquiry with reference to my article on South African Succulents, a number of these are offered by the Knickerbocker Cacti and Succulent Gardens, P. O. Route 1, San Diego, California, and I have no doubt by other Californian dealers. Plants cannot be imported from South Africa except under special permit of the Department of Agriculture. Many of these plants are very readily raised from seed and seeds can be obtained from John Martley, South African Floral Farm, Banhoek, Stellenbosch, South Africa; Miss K. C. Stanford, Bloem Erf, Banhoek, Stellenbosch, South Africa as well as other South African dealers.

T. H. EVERETT.

New York Botanical Garden, N. Y.



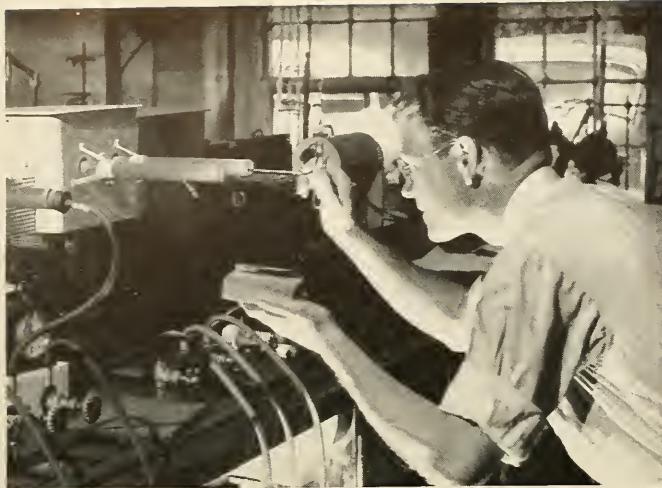
April

NATURAL HISTORY

1938

Jan's Highest Summit • The Indian Court, by Wissler

Ticket to the Arctic • Flowers as Symbols • Lichens



WORTHLESS GOLD

MAGIC failed the alchemists when they tried to change lead into gold. But even had they succeeded, they would not have created wealth. They would only have made gold common—and therefore worthless.

But the scientists and engineers of industry have learned the secret of creating wealth—*real wealth*. By inventing hundreds of new products, and then finding ways to make them so inexpensive that America's 31 million families can buy them, industry has created more real wealth in the last sixty years than had been accumulated in the preceding sixty centuries. As a result, five out of six American families have radios, four out of five have telephones and automobiles, one out of every three has an electric refrigerator. And all enjoy roads, buildings, bridges, public services, and other forms of real wealth worth billions of dollars. More goods for more people at less cost—that is the only way of creating *real wealth*.

General Electric scientists and engineers have contributed greatly to this progress. As a single example, the incandescent lamp has been reduced in cost and increased in efficiency until it saves the public \$5,000,000 a night in lighting costs.

G-E research and engineering have saved the public from ten to one hundred dollars for every dollar they have earned for General Electric

GENERAL  ELECTRIC

1938—OUR SIXTIETH YEAR OF ELECTRICAL PROGRESS—1938



Natural History

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ROY CHAPMAN ANDREWS, Sc.D. Director

VOLUME XLI—NO. 4

APRIL, 1938

Indian Dancing Men.....	Cover Design
From a painting by Ogwa Pi	
Within the Inner Sanctuary.....	Frontispiece 244
The Highest Mountain Ever Climbed.....	Arthur B. Emmons, 3rd 245
After 50 years Nanda Devi's 25,645-foot summit yields to four Americans and four Britons	
Lichens in Your Rock Garden.....	Raymond H. Torrey 265
These almost "forgotten" common plants give a mellow, aged effect	
Sitting with the Indian Judges.....	Clark Wissler 271
The Indians built up an efficient legal heritage without the aid of law books	
Flowers as National Emblems.....	Natalie Harlan Davis 275
Surrounding the selection of national flowers in older countries is abundant lore and legend	
A Ticket to the Arctic.....	Richard Finnie 282
A region now accessible to the amateur as well as the professional explorer	
The Rarest American Spruce.....	C. Edward Graves 294
It is found only in the Salmon-Trinity Alps Primitive Area of northern California	
The Indoor Explorer.....	D. R. Barton 299
Science in the Field and in the Laboratory.....	303
Your New Books.....	305

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THE HIGHEST MOUNTAIN EVER CLIMBED—*Encircled by an almost insurmountable barrier of lofty peaks which frustrated the ablest mountaineers for more than fifty years, Nanda Devi's 25,645-foot summit yields at last to the British-American Himalayan Expedition*

By ARTHUR B. EMMONS, 3RD

AT 3:00 p. m. on August 29, 1936, two altitude-weary climbers forced their way up the last few feet of its icy crest and stood on the top of Nanda Devi, highest summit in the world ever attained by man. Around them on all sides was naught to be seen except great masses of billowy clouds, and far below the mottled brown and white of lesser ranges. The thin cry of a chill wind added to the loneliness about them. Why were they there?

Later, when once more returned to the world of men, one of them was asked the question "why?" Why had they undergone all the difficulty and hardship required to gain so remote a spot of the earth's surface? In reply, the man's answer after some thought was perhaps for a mountaineer characteristically illogical, "Well I suppose somebody ought to have done it."

So much for the reason for climbing the great peaks of the earth—it is perhaps imponderable. More understandable, however, is *how* these two men were able to exist and work in the thin barren outer world of 25,645 feet above sea level, when the upper limit of human habitation the world over is little more than 16,000 feet. Yet there will need to be some explaining.

Groundwork

In some ways the building of an expedition is like the building of a skyscraper; before the final cornice is in place, before the *Times* has announced that yet another Himalayan peak has been conquered, in both cases as much work and effort must be expended on the foundations out of sight below ground as ever appears above.

In the present instance the idea of attempting the

(Left) *A CRAG within the gigantic mountain basin from whose center rises Nanda Devi: native Hindu porters building a shrine among the clouds to the gods of the mountain whose name means "Blessed Goddess Nanda." Below lie the meadows of the Inner Sanctuary*

(Photo by British-American Himalayan Expedition)

ascent of one of the larger Himalayan peaks originated among the officers of the Harvard Mountaineering Club. Nanda Devi was finally chosen as the objective because it was not only one of the outstanding unclimbed peaks of the world but also relatively free from the political restrictions which so often surround the peaks near the borders of Eastern Asiatic countries.

Our first move, of course, was to scour all the existing maps and available literature of previous attempts to explore the mountain. We found at once that the problem of Nanda Devi was very complicated indeed due to the extreme difficulties of the approach. The mountain is completely encircled by a formidable ring of lesser peaks many of which are over 21,000 feet high, higher for instance than anything on the continent of North America. We found that for many years the most accomplished of British mountaineers had tried in vain to scale this precipitous outer wall and had been thrust back time and again. Finally in 1934, two English climbers had managed to gain an entrance to the inner valley and thus were the first ever to reach Nanda Devi.

An amazing route

They had discovered an amazing route through the mile-deep gorge of the Rishiganga River where it cuts the outer wall on the west, and after days of hazardous and extremely intricate climbing along the sides of this gorge, had succeeded in forcing a passage through it. They explored the interior valley and studied the peak of Nanda Devi for a route by which it someday might be attempted. On the north and west great cliffs descended for 8000 feet to block any approach. The eastern side was also unapproachable, but on the south they discovered a steep tenuous ridge which they felt might possibly be ascended by a highly experienced party of climbers. At any rate, here lay the only hope that Nanda Devi could ever be climbed. The experiences of these two Englishmen, Tilman and Shipton, with their three Sherpa porters, in reaching the *foot* of Nanda Devi were considered an epic of mountain exploration.

Thus the situation stood in November of 1935,

when we began our campaign against this great peak whose summit is 25,645 feet high or nearly five miles above the sea. The approach through the Rishi Gorge had proved all but impossible for a party of five seasoned men. It would require 20 or 30 porters to provision a base camp sufficiently to attack this hitherto unchallenged giant among peaks. The odds seemed rather heavy against us.

The first step in our preparations was to assume that it could be done—all mountaineers must be optimists. Following this assumption, a careful plan had to be laid for the attack—a plan minute in detail but withal elastic enough to allow of changes as a capricious fortune might dictate. We obtained the blessing of such of our fore-runners as Shipton and Longstaff. A proper estimate of the number of climbers required to carry out the campaign upon the mountain was of primary importance. They must be men not only of great experience in mountaineering and strong physique, but they must also have the right temperament and psychology. Our personnel must of necessity include no supernumeraries, because of the extreme difficulty of reaching the mountain. Every man must be capable of carrying his share of the burden far up the sides of Nanda Devi. It was necessary to combine both the qualifications of an experienced Alpinist with such functions as doctor, geologist, surveyor or photographer. In addition these men must all be of the type who would get along well together, forming a strong homogenous "team" under great hardship and strain. Assuredly the personnel problem is one of an expedition's greatest headaches!

Experienced mountaineers

It was decided to take eight climbers in all, seven for the assault party and one to be in charge of the base camp and to supervise the porters. One of our hopes had been to ask some of our English Alpine Club friends to join the party. Accordingly we wrote to two of our old companions there with whom we had climbed in Alaska, the Rockies and the Alps. It was further desirable to find a man who knew the route through the Rishi Gorge. There were only two such men and Shipton was away on an Everest Expedition. Tilman was found to be eager to join us, and he proved an absolutely indispensable addition, not only through his knowledge of the route, but also because of his considerable ability as a mountaineer and his knowledge of the language and of the native porters.

In the end, the party consisted of four Americans; Carter, Houston, Loomis and myself. The four Englishmen were Graham Brown, Lloyd, Odell and Tilman. Every man had considerable experience in the mountains and all save one had been on difficult expeditions before. It was not until the 1st of February, 1936, three months after the Expedition was conceived, that the last man had been definitely signed on.

The set-up of the Expedition was somewhat unusual in that there was no officially recognized leader. Where the party was composed of a group of friends, each qualifying in his own field, an arbitrary leader was considered a weakness rather than a strength.

Later on, when vital decisions had to be made as we neared the summit, Tilman was unanimously chosen to direct the operations. However, in its essential quality the Expedition remained a democracy throughout. Though composed of men from two different nations, it was thoroughly homogenous and single-minded in the desire to reach its goal.

The work of organization was delegated to various individuals or groups. Once the personnel and the plan of attack had been worked out satisfactorily, we then proceeded to more definite action. Total weights of food and equipment



British-American Himalayan Expedition

An almost impassable, circular barrier of mountains surrounding their objective was the difficult problem that confronted the Expedition which undertook to climb Nanda Devi in northern India, a summit higher than any previously ascended by man. This barrier embraces at least a dozen peaks higher than any in North America and nowhere drops below 18,500 feet except where breached by the difficult Rishi Gorge. For more than 50 years the

ablest mountaineers tried to cross the outer wall, but without success. In 1905 the crest was attained by Dr. T. G. Longstaff; and in 1934 a passage was forced through the Rishi Gorge by two Englishmen, Tilman and Shipton. Approaching by the same direction, the British-American Himalayan Expedition entered the Inner Sanctuary and ascended Nanda Devi by route shown below. Two of the members returned by way of Longstaff col, at right



(From a model by George E. Peterson and B. Chapman, after a drawing by Arthur B. Emmous, 3rd. Photographed by Coles)

were estimated from the length of march to the mountain and a proper allowance for the ascent from the base camp. The greatest care was used in working out these estimates, and later they were cut and shaved down again and again to reduce the amount to be carried through the grim gorge of the Rishi. Weeks were spent in going over each item of food, each piece of equipment. List after list was made and revised until we felt it to be correct. Nothing was overlooked and only tried and trusted items could be considered. Finally, after the weights had been tabulated and added up, the number of porters needed to transport it could be determined. The totals arrived at were based on food and equipment for eight men and six porters for 80 days (later cut to 60).

With these figures now before us, we obtained from shipping agents the cost of transportation to our point of departure in India. From Tilman we learned what the porters must be paid and other items of expense abroad. A total financial budget was computed, from which we found that the entire expedition could be financed by its members without obtaining support from outside, and thus omit the undesirable previous publicity which that might entail.

As preparations continued it became needful for us to have a liaison officer in England to secure samples of English goods, do the buying and confer with our English climbers. Most important of all, however, were the conclusion of the permits to enter the region just south of Tibet where Nanda Devi rises. We had received "assurances" from England that permission would be forthcoming but it was necessary to conclude negotiations before actually committing ourselves by ordering supplies. Loomis volunteered to make the trip to England and we put him aboard a liner in early February armed with lists and instructions as the Expedition's representative. He carried out his mission ably and before returning on March 1st had received Government of India permission.

Supplies

The next step was the placing of orders for food and equipment. This entailed much correspondence with various firms to see if they could supply us according to specifications. Food was bought largely in this country and augmented from England and India. Dehydrated food was, of course, a requisite in most cases and included milk, eggs, vegetables and meat-pemmican. We had special chocolate made up for us that would withstand tropical heat and yet involved the best combination of ingredients. Equipment came largely from England, though some was

bought in America. Special windproof suits, asbestos-lined boots, high-altitude tents, high-altitude stoves and many other specialized items appeared on our list.

As supplies began to pour into the Expedition storeroom near Boston the work of checking arrivals, sorting and packing began. Almost any afternoon two or three members could be seen busily packing the 60-pound cases, soldering them shut (against tropical dampness), listing their contents and stenciling addresses. In the course of two weeks we packed some fifty cases of supplies, uniform in weight and all numbered to correspond to their listed contents. By April our entire shipment had left for India by way of Suez.

Further preparations involved contacts with several scientific societies. The International Commission on Snow was anxious to have us make studies of snow and glacier conditions. There were several geographical societies which loaned us surveying instruments and were interested in the topography of the region. Odell, a lecturer in geology at Cambridge, was to find much of interest in this unknown district.

Seasonal difficulties

Owing to the fact that most of us could not get away until June, we found it necessary to attempt Nanda Devi during the summer monsoon rains. This season, when it rains or higher up, snows every day, has commonly been avoided for high-altitude climbing in northern India due to poor snow conditions and bad weather on the peaks. However these objections do not apply universally to all parts of the Himalaya, and we felt that perhaps climbing in the monsoon had not been given a fair trial. Warmer weather prevails at that season, and in Garhwal Province where we were to be, there was perhaps less of the strong prevailing northwest wind at that season. We hoped to and subsequently did climb out above most of the bad monsoon conditions high on the peak, leaving a great sea of sodden clouds below us. However, in order to obviate as much heavy work as possible during this bad weather and to expedite our attack later on, it was decided to lay a depot of food near the head of the Rishi Gorge in May and June while the weather was still good.

It was also most useful to have one or two men in India well before we arrived to supervise transhipment of supplies from Bombay to our headquarters at the hill-station of Ranikhet. Reliable porters must be engaged to help establish camps high on the mountain. Accordingly Tilman sailed for India in March. After arranging with the In-

dian customs to admit our supplies through "freedom of the port," he journeyed to Darjeeling, where experienced native porters can usually be engaged. However, due to the requirements of several other and larger expeditions then in the field, none but a rather second rate lot could be obtained. Tilman arranged for six of these to accompany us and took several of them on a short climbing trip in Sikkim around the base of Kangchenjunga.

Loomis sailed for India late in April and joined Tilman at Ranikhet on May 30th. The two men left immediately on their first trip to the Rishi Gorge.

They took with them two Darjeeling Sherpa porters and traveled extremely light. After a week's march over the foothills, they crossed a high pass and descended to the last sizable village, Joshimath, where they purchased 900 pounds of wheat flour and millet and recruited 14 local Mana porters to transport it.

In the next two weeks this advance party penetrated the great chasm of the Rishi, and, following the Shipton-Tilman route, laid a depot of food beyond the major difficulties of the Gorge. By June 25th they returned to Ranikhet in a week of heavy forced-marching, with the knowledge that the route through the Rishi was still unbroken and practical.

"Bagging and scrapping"

The main party arrived in India during the first week in July. We had obtained the use of a spacious Forest Service bungalow in Ranikhet, and there for days on end the floor was strewn with a confusion of boxes, trunks and gear of every description. We found it advisable to start scaling down weight immediately. Food allowance was cut and equipment was rigorously limited to its necessary minimum. Tins were replaced by light waterproof canvas bags to save container weight and we rejected the wooden cases for lighter burlap carrying-sacks. This process became known to the Expedition as "bagging and scrapping" and is highly recommended to those contemplating light mountain expeditions.

Each member of the party was allowed a maximum of 35 pounds for his entire personal kit, and it was not without severe pangs that this or that cherished belonging had perforce to be left behind. Despite our careful estimates and weight-budgeting, we still had 2500 pounds to be transported, later augmented by another 700 pounds of coolie food and the depot in the Gorge. To carry this over rough uninhabited country we secured the service of 37 Dotial porters from the surrounding Villages. With six Sherpas from Darjeeling and later twelve men from Mana, we were rather an imposing aggre-

gation. The great walls of the Rishi loomed more formidable than ever.

A few days were spent in trying to learn a smattering of Hindustani in order to manage the porters who spoke no English. On July 10, 1936 the Expedition departed from Ranikhet and marched ten days through the lower ranges to Joshimath. The road climbed steeply up through magnificent forests to high open passes, then plunged in a series of devious bends to deep river valleys beyond. The monsoon was full upon us, and it rained the greater part of each day.

At Joshimath we were joined by our twelve Mana porters who had been arranged for in advance. They were loaded with additional porter food and then the Expedition started off up the valley of the Dhauli which comes rushing and tumbling down through the ranges from the hinterland of Tibet to join the Alaknanda, tributary to the sacred Ganges.

After two days' march along this valley, we left the last vestige of civilization and struck up the side of a great spur which flanks the valley on the south. The path became a mere shepherd's track up through the forest. We scrambled over steep, grassy slopes until at 14,300 feet we came to a wild desolate col amidst towering broken crags. Beyond, the ground fell away in a series of cliffs and hanging meadows to the Rishi River 7000 feet below. The rugged grandeur of this country was breathtaking and every now and again we caught glimpses of jagged spires of rocks and snow through momentary rifts in the clouds.

Descending abruptly for several thousand feet across a ragged face of rock, we began a traverse up along the north wall of the middle gorge. The track ceased to exist and progress was made more or less by "dead reckoning" across precipitous slopes of grass-covered rocks. To those unused to such terrain it proved rather trying, for carrying packs as we were, the rain-soaked rocks were treacherous.

Three days after descending into the middle Rishi, we were confronted by a deep cleft in the valley wall cutting across our route at a right angle. This was the Nullah of the Rhamini and it forced us to climb down steeply for 1500 feet to its floor where a crossing of the stream might be effected.

Porters desert

We found the Rhamini so swollen by the heavy rains and the melting glacier above it that, after a few tentative tries, we were forced to abandon any thought of crossing it that day. The Dotial porters had had about all of this rough going they could stomach and the combination of a raging torrent

athwart their path and the fear of the traditional demons of the Rishi proved too much for their ardor. The following morning, though we managed to get a rope over the torrent and make a crossing, all 37 of them asked for their pay and left for home.

Having lost over half our man-power even before reaching the rigorous passage of the main Rishi Gorge, we now had to call upon the elasticity of our former plans to compensate for the emergency. The loads were swung above the stream on ropes and landed on the farther bank. Then in three relays we carried everything down to the foot of the main Rishi and across a precarious natural rock bridge to the opposite shore of the main river, where camp was set up. This loss of our porters put us a week behind schedule in reaching the mountain.

After a council of war, it was decided that by further rigorous cutting of our food and equipment we might be able to move our gear forward in two relays, each man, including the white sahibs, carrying full 60-pound loads. A substantial depot of food was left here at the base of the cliffs for use on our return journey. Then we tackled the main walls of the Upper Gorge.

Chasm almost impassable

All that had been said and written about the difficulties of the upper Rishi we found in no way to have been an exaggeration. Rather, we felt if anything they had been described all too modestly. The river here dashes down through a breach in the mountain barrier for about five miles. The walls of this chasm in places drop sheer from snowy peaks on either hand for 8000 feet to the foaming Rishi below, which fills the floor of the cleft more or less completely.

Our only route lay across the tremendous cliffs and buttresses of the south wall, the north wall being unclimbable. Assuredly the Rishi deserves its reputation as one of the most formidable gorges to be found anywhere in the world. Framed in its dark recesses and bold crags we could see ahead of us the gleaming spire of Nanda Devi soaring up to nearly 26,000 feet, remote and inspiring, within her sanctuary. No wonder that the Hindus through the ages have regarded her as the dwelling place of the gods and this grim gateway the abode of her protecting demons.

The route along the south wall was remarkable for its ingenuity and sheer optimism. We climbed steeply above the natural bridge for 2000 feet then traversed along at nearly the same level for the entire length of the Gorge. Tilman and Loomis led us along one minute ledge after another and, when each ledge petered out in a blank wall or abyss, they

took to a hidden crack or couloir which gave access to the next level. The climbing was amazing, stimulating and at times not a little hair-raising.

The necessity of climbing unroped with large loads required a new technique. The steeply inclined slabs of out-sloping sedimentary rock, often covered with a veneer of grass or bushes, required delicate handling. In one place a rope was fixed to aid the laden men, in another it was necessary to haul the loads bodily up a stiff section of cliff on ropes. Two camps were pitched on ledges, and after a week of relaying provisions from the bridge we emerged thankful and jubilant within the inner valley. The only loss incurred had been one load of oxygen apparatus and kerosene dropped into the void by a careless porter.

The Inner Sanctuary

The broad grassy swales of the Sanctuary proved a most pleasant change from the grim shadows of the Rishi. For two stages we marched across meadows carpeted with a profusion of wild flowers. Herds of tahr* and bharal† regarded us curiously from the hilltops and we saw several varieties of pheasant. Another day's march along the glacier laying at the foot of Nanda Devi on the south brought us to the base of our ridge.

The Base Camp was finally established at an elevation of 17,000 feet near the foot of the main south ridge. On August 8, the Mana porters were sent back through the Gorge. They were untrained and unequipped for the more specialized work of the high-altitude camps and their tour of duty was finished. They had proved their worth. With them returned Da Namgil, a Sherpa who was ailing. He had instructions to return to Joshimath, send off dispatches by telegraph, pick up our mail and return to the Base Camp with six men to help us on the return journey. He carried out his instructions to perfection.

After a two days' rest to overhaul our supplies for the main attack, the actual ascent began. In general the plan of attack was as follows, though again it must be elastic enough to allow of sudden changes. At great altitudes, where the pace of a strong climber is reduced to 200 or 300 feet an hour, it is not possible to ascend with loads more than 2000 feet a day. Thus on Nanda Devi we would require six or seven advance camps above the Base to come within striking distance of the summit. The placing of these camps and the maintenance of a safe line of communication between them required considerable organization.

* A goat-like animal of the genus *Hemitragus*.

† A blue sheep of Tibet and adjacent parts.

Continued on page 313



(Above) MEMBERS OF THE BRITISH-AMERICAN HIMALAYAN EXPEDITION, which succeeded in scaling Nanda Devi (25,645 feet), the highest summit ever reached by man and one of the most inaccessible mountains in the world. The plan to ascend the mountain originated among

the officers of the Harvard Mountaineering Club and included four English climbers and four Americans. *Left to right:* Tilman, Loomis, Graham Brown, Houston, Lloyd, Odell, Emmons, Carter. The mountain had been an objective of explorers for more than 50 years

ASCENT OF NANDA DEVI

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(Left) SORTING AND PACKING expedition supplies at the hill station of Ranikhet just before the take-off. Each member was allowed a maximum of 35 pounds for his entire personal kit. Fifty-five porters were required to transport the food and equipment necessary for the attack on Nanda Devi

(Right) SMILING CHEERFULLY with 60 pounds: Nima Tsering, one of the Sherpa porters attached to the Expedition. These men, who spend their lives in the mountains of Sikkim, are among the strongest and most experienced porters in the world and are cheerful under severe conditions. This man carried his load higher on Nanda Devi than any other porter





(Left) A YOGI HERMIT living among the wild mountains of Garhwal Province, on the border of Tibet. A pious Hindu, he has let his hair grow to a length of 10 feet. He had seldom seen white men before

All photos by British-American Himalayan Expedition

(Below) PRINCIPAL TRIBUTARY to the great Ganges, the Alaknanda River winds down from the mountains near Tibet through a series of deep gorges. Along its banks for 200 miles runs the Pilgrim Road to Badrinath. The Expedition traversed this section in mid-July, and it rained the greater part of each day. Note the terraced rice fields on the mountain slopes

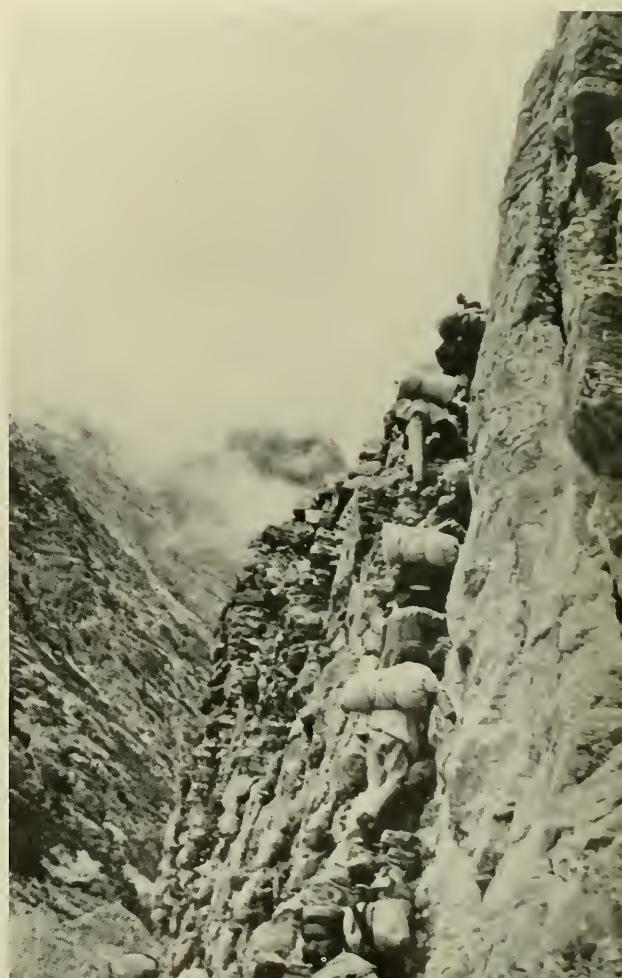




(Above) THE HOLY CITY OF BADRINATH, 10,000 feet up among the peaks. The city lies near the source of the sacred Ganges and is the object of pilgrimage for many thousands of Hindus from all parts of India every year. The gold-roofed temple at the extreme right has in it the black stone idol of the god Badri

(Below) PORTERS ASCENDING THE "GOLDEN STAIRS" high on the walls of the mile-deep Rishi Gorge, the one passage to the Inner Sanctuary. It was often over just such a narrow ledge as this that the only route could be found

(Below) FROM THE CLIFFS at the left drop the falls of Bhasadura, which the Hindus regard as the source of the Ganges. Pilgrims visit the spot annually by thousands. The village of Mana, where the Expedition recruited some of its staunchest porters, is seen at the right. It lies within a few miles of the Tibetan frontier





(Above) A SPECTACULAR PASSAGE through one of the greatest natural barriers in the world: members of the Expedition approaching the great cliffs of the Upper Rishi Gorge. The route beyond this point became devious and well-nigh impassable. The steep opposite wall is seen to the left, while the river lies many hundred feet below.

(Right) THE PARTY resting on a shelf part way through the Gorge. It required 25 men a week to transport the Expedition supplies along its walls to the foot of Nanda Devi in the Inner Sanctuary





(Above) HIGH ON THE WALLS of the Rishi an overhanging cliff made it necessary to raise the loads on ropes. This procedure was used in several places where it was impossible to climb with a load on the back

(Left) AHEAD could be seen the great bastions of the Rishi, across which the Expedition would have to climb. The river lay several thousand feet below to the left. The snowy spire of Nanda Devi comes into view at the edge of the cliffs high up to the right



(Above) CROSSING a precarious bridge of logs balanced above a rushing mountain torrent that blocked the way. These streams, which have carved deep chasms in the mountain walls, were one of the Expedition's worst problems



(Above) A HEAVILY LANDED CLIMBER making his way over a natural rock bridge across the main Rishi, a slippery job even when assisted by logs. Loads had to be swung down the cliffs behind, one being thus lost

(Right) ONCE THROUGH THE GRIM DEPTHS of the Rishi Gorge, the Expedition came upon the delightful flower-strewn meadows of the Inner Sanctuary, the second party ever to have set foot in this remote corner of the Himalaya. In the background rise the southern walls of the circular valley from whose center Nanda Devi rises to a height nearly five miles above sea level. The lowest point on the valley floor is over 14,000 feet in altitude





(Left) A HUMAN CHAIN across the wild torrent of the glacier-born Rhamini River: a crossing which was made only after much difficulty. Loads had to be swung across on ropes above the stream

At this point the traditional demons of the Rishi proved too much for 37 of the porters, who deserted and returned home. Having lost over half its manpower the Expedition was forced to further reduce food and equipment and to double up on loads. The loss put the party a week behind schedule

(Below) THE FIRST CAMP on the meadows of the Inner Sanctuary. Behind lie the cloud-filled depths of the Rishi and at the right the ragged cliffs of Nanda Devi which shoot up yet another 12,000 feet to the summit



(Below) IN BARE FEET the native porters found carrying loads over the moraines of the South Glacier an arduous task. The Base Camp was reached only after four miles of such terrain





(*Above*) TRAVERSING DEBRIS-COVERED GLACIAL ICE lying on the valley floor of the inner basin.

Ahead loom the great ramparts of the rim a mile high and impossible of ascent



(*Above*) A CAMP and food depot were placed beside the moraines of the South Glacier over which the route lay to the Base Camp. The summit was still two miles above

(*Right*) ASCENDING A STEEP GULLY above the South Glacier to the Base Camp at 17,000 feet. These shale slopes proved strenuous climbing with a 60-pound load. The glacier is here a third of a mile wide





(Left) BASE CAMP was placed on a high shoulder near the foot of the southeast ridge of the mountain, seen at upper left. This photograph is much foreshortened



(Right) PAYING OFF the twelve Mana porters at the Base Camp. These local native hillmen had proved their loyalty and ability in a remarkable fashion. Their pay was one rupee (38c.) per day

Within the “Inner Sanctuary”



(Right) A PLACID LAKE and greensward at three miles above sea level, lying within the Inner Sanctuary, whose walls rise behind. Around the margins of this lake were many tracks of wild mountain sheep and goats which had never laid eyes on men before: a paradise completely shut off from the outside world



(*Above*) AN UNNAMED PEAK of 22,000 feet forming part of the southern rim of the Basin. This is a telephotograph taken from six miles away. The wall at this point is 6000 feet high

(*Right*) A COLUMN of men and porters laboring up over steep slopes below Camp I. The summit of Nanda Devi is out of sight above





(Above) THE LOWER PART of the southeast ridge as seen from the Base Camp. Rockfalls from the cliffs compelled a cautious approach. Above this level ropes were used extensively by the climbers for safety



(above) A TENT perched on its platform at Camp I (19,500 feet), looking steeply down to the glacier floor of the valley. There were six such camps above the Base Camp. The route is here shown from the Base Camp

(Right) A TELEPHOTOGRAPH of an unsurveyed peak (21,300 feet) which is part of the barrier ring surrounding Nanda Devi. For more than fifty years experienced mountaineers had tried to cross this barrier without success until in 1934 Tilman and Shipton found a route through the Rishi Gorge. The snowfall in the central Himalaya in summer is heavy due to the monsoon winds from the Indian Ocean





(Above) THE TREMENDOUS SPIRE of Nanda Devi as seen from three miles away on the south. Eight thousand feet of ice-covered rocks rise above the clouds. The ridge by which the Expedition made the ascent runs diagonally up from the right center of the photograph. The mountain, whose summit is the highest ever trod by man, is an enormous column of sedimentary rock. Marine fossils were found not far below the top showing that once it was submerged beneath an ancient sea

(Right) CAMP IV, 22,000 feet high on the desolate windswept slopes of Nanda Devi. Far below, lost in the deep shadows, lies the green valley of the Inner Sanctuary. Life in these high camps is not often an easy one, but the exhilaration of seeing the world spread out below makes it an unforgettable experience

(Right) MAPPING THE NANDA DEVI BASIN: Tilman and Emmons at a surveying station high among the peaks. Little was known of the remote country surrounding the lofty mountain. At least a dozen peaks higher than any on the North American continent rear their snowy heads from the barrier wall



(Right) TWO NATIVE PORTERS who assisted in the work of the survey by carrying instruments to high points of vantage. Bad weather attending one of the worst monsoon seasons in decades made the work slow and difficult

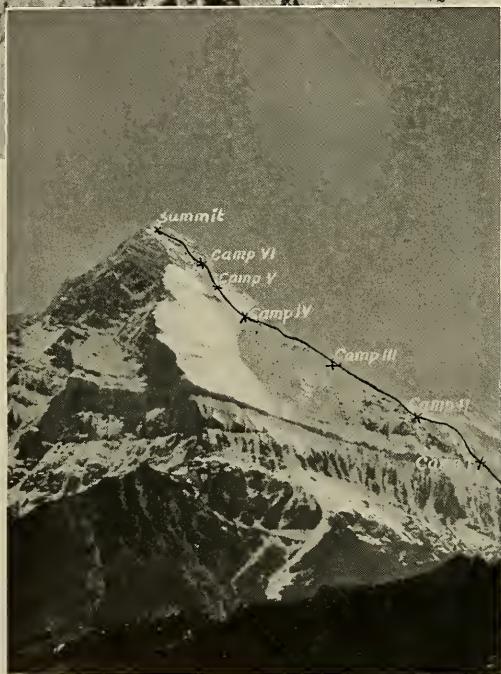


MEMBERS OF THE ADVANCE PARTY are seen making up their packs at Camp IV, at right. Everything had to be carried on the climbers' own backs in establishing the four upper camps. Behind are the slopes of Nanda Devi, while in the distance rise the peaks of the Badrinath range 40 miles away





(*Above*) THE VAST SWEEP of the encircling barrier rim as seen from high on the slopes of Nanda Devi. This land has seldom been seen by man before



(*Above*) THE JAGGED WEDGE of Nanda Devi as viewed from a valley glacier. Against the skyline can be seen the south ridge. This photograph is greatly foreshortened



(*Right*) A PHOTOGRAPH taken on August 29, 1936 from the highest of mountain summits ever attained: the culmination of more than fifty years of mountaineering effort. In the distance are seen the cloud masses of the monsoon sweeping over the summits of the surrounding peaks

LICHENS IN YOUR ROCK GARDEN—How to achieve the mellow, aged effect that Nature has created on old stone walls and buildings by using these almost “forgotten” common plants

By RAYMOND H. TORREY

ALMOST everyone who has a suburban or country place with sufficient grounds includes a rock garden in his scheme. But as all can see, a rock garden may vary widely in quality. Often the rocks are merely broken up fragments of dressed building stone, obviously unnatural in line and appearance. The plants are whatever the builder or the nurseryman supplies, and while they have their periods of beauty in bloom, the fundamental layout is clearly artificial.

As a means of getting a mellowed, natural effect, Nature's method of utilizing such basic plant forms as lichens is recommended. In older countries than ours, Nature has used lichens in a centuries-old process of covering the blunt lines of buildings and roofs, healing the scars of ruins and decorating old walls and fences with beautiful forms. John Ruskin, apostle of the beautiful in art and Nature, has given one of the finest appreciations of the functions of such plants:

Lichens and mosses—how of these? Meek creatures, the first mercy of the earth, veiling with hushed softness its dintless rocks, creatures full of pity, covering with strange and tender honor the scarred disgrace of ruin—laying quiet fingers on the trembling stones, to teach them rest.

But even in our own country, almost any ancient talus slope strewn with rocks that fell from the cliffs as long as ten thousand years ago, shows the smoothing and binding effects of lichens which cover the stones with sea-green thallus forms making what was once a raw bare slope an expanse of soft coloring.

Then, too, certain of our forefathers' tombstones, in older cemeteries and church yards, dating back two centuries or more, display the “strange and tender honor,” that touched Ruskin. One of the best ex-

RAYMOND H. TORREY, whose particular outdoor hobby is the study of lichens, is active in scientific and conservation groups. He is related to John Torrey, eminent American botanist (1795-1873), through their descent from William Torrey, who settled in Weymouth, Mass., 1640. He has been chairman of the field committee of the

Torrey Botanical Club since 1927. He was elected President of the Club (which was named for John Torrey) in 1938 and organizes its large program of study trips. He is a member of the Board of Managers of the N. Y. Botanical Garden. He is a member of national and regional scientific bodies. Since 1920 he has con-

ducted “The Long Brown Path,” an outdoor column in the *New York Post*. He is one of the authors, with Frank Place and Dr. Robert L. Dickinson, of “The New York Walk Book,” covering walking territory within 100 miles of New York City.

—THE EDITOR.

LICHENS

The Hardy Pioneers of Plant Life

Lichens are one of the commonest yet least known groups of plants in the world. Although enjoying no such popularity as their remote cousins the flowers, their botanical importance is immense, for, without them, few flowers could come into existence. Lichens are the pioneers of vegetation and soil formation. By overrunning a barren local-

ity, they make it habitable for more advanced life. Adapted to thrive under the harshest conditions, lichens grow almost anywhere—in the blistering desert heat or arctic cold—taking firm root in soil, wood, rock, or even window-glass. Their world-wide distribution includes thousands of forms from the featheriest of filaments to flat crusts.

THREE LICHEN TYPES usually found on earth and old wood are shown at left. The upper part of picture shows samples of *Cladonia cristatella*, distinguishable by their bright red crests. The tall bugle-like cups (center) are fringed with brown and are called *Cladonia gracilis dilatata*. The larger cup near the lower left corner is *Cladonia chlorophphaea*, a very common lichen. These types are among the "radiate lichens," which have developed upward like shrubs in the struggle for air and sunlight—the two indispensable requisites of most lichens. The crustose or flat, spreading types are the more primitive forms



(Above) REINDEER LICHEN (*Cladonia rangiferina*) is the staple food of reindeer and other vegetarian animals of the far north where it abounds. In Lapland, *Cladonia alpestris* is the commonest lichen eaten by reindeer. For humans the food value of lichens is low and the taste bitter, but some arctic explorers have munched them after boiling to stave off starvation, and Northern dwellers are accustomed to grind up lichens, leech out the acids which most forms secrete, and mix the residue with meal to make bread. The firm belief that this practice is good for the health can be traced to the fact that roughage is thereby added to the diet. Although lichens are of small value to man, commercially or as nutrients, some authorities think they were the manna of the Israelites and certain maritime species in China and Japan are considered a great delicacy

(Right) A "FOLIOSE" LICHEN often found on trees, *Cetraria atlantica*

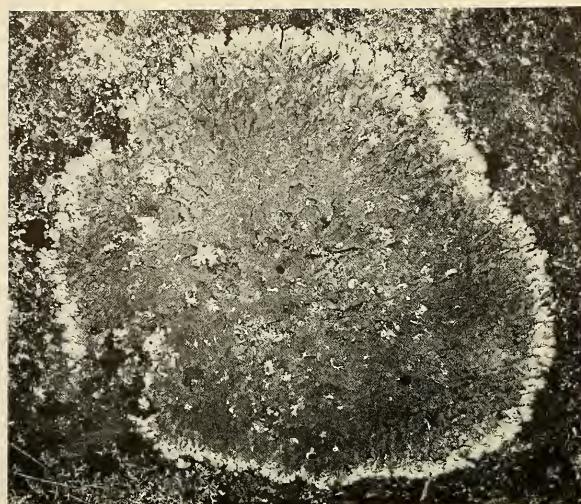


UMBILICARIA MUEHLENBERGII: one of the rock tripe lichens which has been eaten by man. This species is quite common in the Middle Atlantic states. Nature lovers in search of lichens are cautioned not to look for them near industrial areas where the smoke and other impurities in the air are inimical to their growth

ALL PHOTOS BY
DEVEREUX BUTCHER

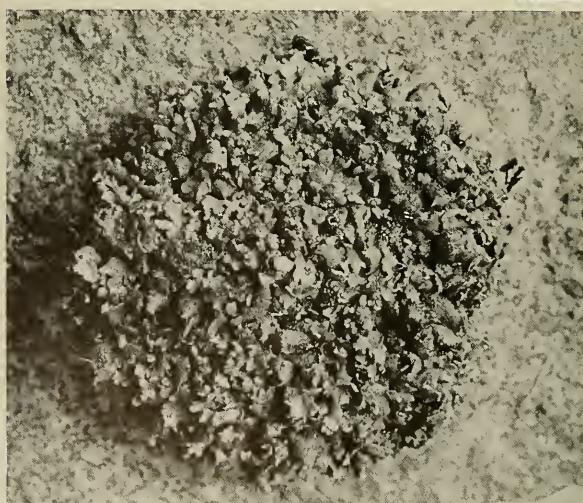
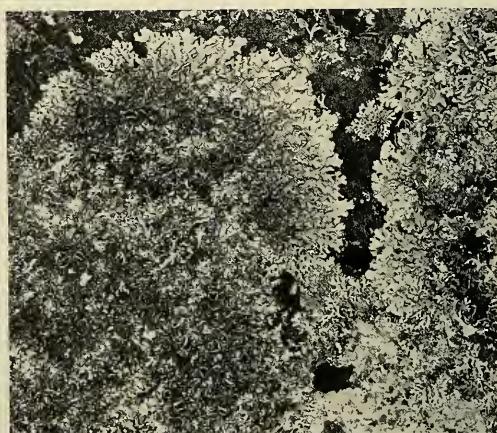


THE VARIETY OF PLACES in which lichens grow is partly explained by their method of propagation. Lichen spores are carried considerable distances by the winds and will start a new growth wherever they come in contact with algal cells of the species with which they have been accustomed to live for ages—provided that proper conditions of temperature and moisture exist



(Left) ROCK LICHEN (*Parmelia conspersa*), one of the commonest and hardiest of all forms. This type fastens itself to rocks with its sucker-like hyphae and gradually disintegrates the rock surface by discharging acids. Being pioneers, lichens are seldom in competition with other plants for food, which they must extract mostly from inorganic particles in the air. Although some types are found in shaded places, lichens in the main constantly seek light and air, which they will go to great adaptational lengths to secure. To this end, one form attaches itself to heather and another, becoming completely rootless, blows about on the breezes

(Right) ANOTHER SPECIES of *Parmelia*, showing the complex leaf-structure. Biologically, lichens are symbiotic plants, meaning that they are not one plant but a combination of two (the alga, a microscopic one-celled plant, and the mushroom-like fungus), uniting in simultaneous and mutually beneficial growth. Products of this symbiosis are the complex lichen acids which have much to do with the color of each form. Lichen colors range from the predominant soft grey through yellow and various shades of brown and red. Lichens were widely used as dyes from earliest times up to the discovery of aniline dyes. Today although litmus paper is still made from lichen dyes, they have fallen out of favor, partly because they have no effect on linen or cotton but largely because lichen dyes are not obtainable in mass-production quantities



CLADONIA STREPSILIS showing one of the more curious shapes taken by lichens. In former times, according to the "Doctrine of Signatures," the resemblance of some lichen shapes to the organs of the human body was regarded as indication that they had curative properties. This fanciful ascription has since been scouted, and although one species ("Iceland Moss") has been used as a specific for throat and chest troubles, lichens are now considered of slight medicinal value

the film of soil left by the decay of the earlier growths.

Nature is slow and patient, content to take hundreds of thousands of years to get such effects. But we want to start making our rock garden look old and mellow this spring. We want our effects in a hurry. And we can get them by careful selection of natural material and by transplanting in our own rock garden what Nature has taken long years to perfect. But it is not enough simply to want to make a rock garden that will be different from the run of the mill in its naturalistic effect. There must be a willingness to wander into strange countrysides, off the concrete highways onto dirt roads, in a sturdy automobile that the owner doesn't mind messing up a bit with dirty footprints and muddy rocks. Given this willingness and a reliable elementary handbook of such non-flowering plants as the lichens, mosses and liverworts, the amateur rock gardener will be well on his way toward getting that smooth, aged, weathered look he so desires in his garden.

City air hostile

To save wasted effort resulting from selections of lichen plants that stand little chance of surviving, some knowledge of the possibilities of the more common lichen forms is desirable. The most important thing to bear in mind before starting out on such a transplanting project is that lichens do not survive city surroundings. Gases in the air of large cities or near industrial districts cause lichens to pine, become sterile and at length to disappear altogether. Records of lichen species in botanical journals show that forms like those now appearing in the highlands 30 to 50 miles from Greater New York, once grew in Central Park. But lichens may now be found within the area of the Greater City only in such relatively open, unbuilt or non-industrialized districts as southern Staten Island or eastern Queens Borough.

If the locality of your prospective rock garden is in a suburban district, reasonably removed from industrial gases, you are safe in beginning the work of collecting. When you do so, however, make no attempt to detach the lichen from the rock or boulder in which it was found. Such a course would prove fatal to any rock lichen. Take the lichen-covered stone intact and when the time comes to pack your collection in the automobile, be careful to forestall the grating of the rocks against each other in such a way as to bruise the lichen surface.

Now let us consider what may be done with reasonable prospect of early results and how and where to get material.

Although interested students will find many other forms, the most common lichen in this region and

throughout the North Temperate Zone is the Rock Lichen or *Parmelia*, most frequently represented here by *Parmelia conspersa*. This is a foliose, that is, leafy sort of lichen ranging in color from gray-green to sea-green and growing rather closely pressed to all sorts of rocks—granite, sandstone, limestone, trap rock, etc. At maturity, this plant has spore-bearing chestnut brown disks, looking like little pumpkin pies. *Parmelias* vary in size from young ones less than an inch in diameter to older plants, one to three feet across. These latter specimens may be centuries old for the annual growth is only a tiny fraction of an inch. *Parmelias* cannot be taken from the rocks for that would tear and destroy them, but millions of glacial boulders in our highlands and many of sizes convenient to handle are covered with *Parmelia conspersa*. These provide an ideal soft, gray-green background for the garden, and if the location is favorable are almost certain to thrive.

It would be well worth the collector's time to make a number of trips into the country in search of *Parmelia*-covered boulders. Rocks bearing any of the flat, non-leafy type of lichens would also add to the soft, weathered appearance of the garden. The flat types of lichens which coat so many boulders in our woods and fields may not appear as attractive to the eye as the leafy *Parmelias*, but the collector may take a fancy to *Biatorella clavus* with its tiny black disks, or "brownie buttons," which would lend a subtle touch to his garden.

In the 30 or 40 thousand years since the ice of the last glacial period retreated from this region, lichens have been growing on the boulders left by the great glacier. They cover the surfaces to a degree not generally realized except by botanists. The flat non-leafy (crustose) lichens started first after the ice age subsided, then, as time went on, the foliose type came, and now, in the cracks and around the rims of ledges, the erect forms, such as the *Cladoniae* are apparent.

Where to look

Brighter colors in these crustose lichens are found on limestone ledges or on limestone boulders transported by the glacier into the granite-gneiss regions of the New Jersey and Hudson Highlands. Pioneer settlers had to clear these boulders off their land in order to plough it, and many of the stones have been gathered to form walls about the fields. Species of *Caloplaca* with orange or copper-colored disks brighten limestone ledges in Warren and Sussex Counties in New Jersey, in western Orange County, New York, in the limestone areas in Dutchess and Putnam Counties, east of the Hudson, and along the Housatonic Valley in Connecticut. They may also be

found on glacial cobbles or boulders north of the terminal moraine which runs on a line from New York Bay, via Summit, Morristown, Dover, Hackettstown in New Jersey to Belvidere on the Delaware and northwest across northeastern Pennsylvania. An old stone wall in some abandoned woodlot or overgrown pasture, makes an excellent source of stones suitable for convenient gathering, but rock-gardeners who plan to raid such walls had better see the farmer first.

Colorful types

In the rock garden's foundation, its walls, holding banks, and in the support of the flowering plants, some of the commoner lichens add the distinctive, mellow touch. But when the prospective rock garden builder has gone this far in his use of lichens, he may want to add originality by introducing some of the more colorful lichen species, such as the numerous *Cladoniae*, into the crevices and spaces between the rocks. *Cladoniae* are an erectly branching (fruticose) type of lichen. One of the most attractive forms is the scarlet-tipped *Cladonia cristatella*, a really beautiful plant. If its scarlet fruiting bodies (apothecia) were as big as tomatoes, the plant would be breathtakingly gorgeous, but it is small—only an inch or two high—and often escapes general attention. Because of its scarlet tips, it has received such quaint folk names as "cigar moss" (resembling a lighted cigar), or "British soldiers" after the red-coats of the American War of Independence. My experiments with this beautiful little plant in a lichen garden I once helped to build at Bear Mountain Nature Museum did not last long enough to be convincing. On earth it seemed to live; on dead logs, subject to drying out, it kept shape and color for months, but did not grow. I believe, however, that if it were gathered from its natural habitat with plenty of earth sub-stratum, planted among stones in a rock garden, watered along with the other plants, it would survive indefinitely.

If the reader is prompted to try this plant in his rock garden, care should be taken to gather the earth under it for two or three inches at least. Furthermore, the clods should not be broken, but brought to your garden intact. It is advisable to take only the plants found growing in earth, as I do not believe that the log-growing *Cladoniae*, although plentiful in Nature, would survive transplanting. In its natural state, the plant grows in banks of rich scarlet along the edges of old woodroads or banks where it gets the sun part of the day. If this situation could be duplicated, it would be a notable addition to the rock garden and one that would delight both the owner and visitors.

Some of the earth-growing, brown-fruited *Cladoniae* did well in the experimental garden at Bear Mountain, and if they are gathered with plenty of unbroken clods beneath them they should survive and renew their growth. Such species include *Cladonia subcariosa* and *clavulifera*, common in old fields, on banks along woodroads, and elsewhere. One has to stoop and search for them, for they are unlikely to catch the eye from a standing position. Look for stalks of green or grey-green an inch or so high with flat scaly thallus lobes below on the earth and brown frufts at the tips. The cupped *Cladoniae*—"fairy cups" or "fairy goblets" to the children—are quaint and odd and would certainly give an unusual touch to your garden. They also should be gathered with plenty of earth under them to give them the best chance of survival.

There are about 40 species of *Cladonia* in our immediate range. Some delicate forms growing in restricted habitats would hardly survive transplanting, but many species would grow, and experimentation with them might well prove worth-while.

Another fruticose or vertical-stemmed lichen, common in New York's vicinity and growing under conditions such as would indicate its ability to survive transplanting, is the pink-fruited, white-stalked *Baeomyces roseus*. This scientific name may be translated as "looking like a little pink mushroom," which is quite appropriate. It forms dense banks on clayey soil along old roads and along new shoulders and banks of highways where it helps to bind them. This plant has coral pink apothecia which burst forth after every sustained rainy period. It thrived in the Bear Mountain lichen garden and if given regular watering, should do well in a rock garden where there are clayey banks or other suitable spots to be covered.

Use of lichens, sometimes intentionally, sometimes more or less accidentally, together with other so-called "lower" or cryptogamous plants (mosses and liverworts), has already been made by amateurs who seek better effects, or more immediate "ageing" of their rock gardens, and to some extent by commercial builders and planters, as has been seen in recent flower shows and in more carefully planned rock gardens. But few commercial dealers supply mosses and lichens except in special jobs for those to whom money is no object. So most amateurs who choose to utilize them will probably find the suggestions outlined above valuable. Obtaining earth-lichens within the New York vicinity and adapting them to rock gardening in a clean-airied district would be at the very least an interesting experiment. And if a number of species can be made to flourish, it will undoubtedly be of permanent usefulness in improving the esthetic qualities of such plant culture.

SITTING WITH THE INDIAN JUDGES—*To administer justice the white man must rely on tons of law books, yet long before Columbus the Indian built up a highly efficient legal heritage without writing down a single word*

By CLARK WISSLER
*Curator, Department of
Anthropology, American Museum*

THOUGH in many respects the Indian court that was established in the '70's and '80's soon became the most important institution on the Reservations, it was often the least in evidence. A stranger could easily spend weeks about a given agency, observing and dipping deeply into the life that came and went, without discovering the court's existence. It came to my attention quite by accident when a trader introduced a dignified Indian as "The Judge." On inquiry, I learned that there was a court then sitting and gladly accepted the Judge's invitation to attend.

Native dignitaries

The courtroom was plain; a few rude chairs for the officials, rough pine seats for those in attendance. The aroma of the Indian pipe was everywhere, giving the feeling that, for once, I was standing in a government building in which the Indian could feel at home, even as a prisoner. The Judge to whom I had been introduced and two venerable colleagues, all bearing themselves with even more dignity than an outstanding Indian habitually assumes, took their seats behind a rude table which I rightly assumed to be the Bench. No one announced their entrance as in a white court.

Aside from their impressive countenances, what particularly impressed me was their clothes. They wore full black custom-made suits, of the type donned by white men only on special occasions; white shirts, rolled collars, and, instead of moccasins, well blackened shoes. Shortly after they had taken their positions, the Agent entered—a sure sign that an important case was to be heard. An attending Indian policeman, his heavy pistol sagging at his loose belt, left the room, returning soon after with two women, one of whom came forward bold and defiant, the other hesitating and timid. The first proved to be the chief offender so the proceedings began with her. No one went through the formula of asking her

name, etc., as in a white man's court. I supposed that in a place like this, where common sense rather than hoary ritualism was the order of the day, that question did not arise. No doubt, I was the only person in the room ignorant of her name and identity. Later, I learned that a good English translation of her name would be Standing-woman.

Standing-woman was an impressive figure, tall, obviously strong and muscular as an athlete. Her countenance was rather hard, and her eyes flashed defiance. Over her head was tied a large faded, but clean handkerchief, her dress was of red dotted calico cut in Indian fashion, moccasins on her feet, and of course, the ever-present trade blanket. The other woman whose name I did not learn, was perhaps a little older, thin enough to suggest an underfed and slightly dissipated existence. Her countenance was blank, her clothes in disorder and by no means clean, but the most conspicuous feature was a large white spotless bandage encircling her head and face. Obviously she had just been treated by the agency doctor.

The trial

The proceedings opened with a question from one of the judges, and since the Agent was present it was necessary to have everything interpreted—fortunately for me.

Judge: "Did you beat this woman over the head with a water pail?"

Standing-woman: "I did."

Judge: "Why?"

Standing-woman: "She came around making a fuss. I told her to go away, to leave me alone. She continued until I beat her over the head with the water pail."

Judge: "Are you living with the husband of this woman?" (the one with the bandaged head)

Standing-woman: "Yes."

Judge: "Why?"

Standing-woman: "She had a good man who worked hard, but she was lazy and always nagging. I am a good woman and work hard; I needed a

good man so I took him into my house. Then this woman came around making a disturbance, so I beat her over the head with a water pail."

There was a deliberate pause, then a second judge asked:

"Standing-woman, did you have a previous husband?"

Standing-woman: "Yes."

Judge: "Where is he?"

Standing-woman: "He was lazy, no good, quarrelsome, so I ran him away."

Judge: "Where did he go?"

Standing-woman: "To live with this woman," pointing to the one with the bandaged head.

The judges went into a huddle for a brief discussion, but soon returned to their seats. One of them asked the policeman if the two husbands were waiting and upon being assured that they were, requested their presence. So the two men were brought in, taking their places beside the women. The four now stood in a row. Standing-woman with her new man at her left, next on her right the bandaged woman, and then the former husband of Standing-woman. One of the judges then addressed each man in turn as to his future intentions; each declared that he intended to continue under the present arrangement. Standing-woman next declared that her intention was also to abide by her *fait accompli*. Finally, the woman with the bandaged head was asked if she preferred to live with the man on her right; since she had the last turn, about all she could do was nod her head.

Two divorces, two marriages

While the judges engaged in further consultation, the Agent turned to me, asking how I would decide this case. My reply was that the whole matter seemed to have settled itself; the only thing remaining was to enter into the agency record two divorces and two marriages. It so happened that the judges recommended such a procedure, in which the Agent concurred. Then one of the judges lectured the culprits upon their unseemly conduct, recalled to their minds the traditional ideals of virtue, and admonished them to live in peace. Nothing was said about the bandaged head, perhaps the judges believed a little letting of blood was necessary to real social adjustment. I left the court, doubting the legality of the procedure but fully approving it and admiring the bold short cuts taken by these illiterate judges. In our courts, a judge, several lawyers, a jury or two, no telling how many witnesses, a few stenographers, and a few clerks would have labored several weeks to untangle a similar situation.

"Tell it to the judge," may be an ultra-modern phrase, particularly in tabloid journalism, but it expresses such a basic human relation as to make easy its translation into the most primitive of unwritten languages. Among the aboriginal Indians of North America, the phrase would have implied standing face to face with the highest human wisdom backed by that of the gods. The ancient Semites looked upon their Supreme God as a great judge, and while the Indian did not lean so far in that direction, he knew that if his society frowned upon his behavior, he must make answer, sooner or later, to its leaders, and through them to the Great Unseen. In aboriginal society, rules were made to be obeyed, but like many such rules in all kinds of societies, it was often difficult to make them apply to the complicated situations in which one must actually live. So, even in the aboriginal scheme of things, the judge steps into the picture to interpret the rules and fix the penalties. In other words, there were judges in America long before Columbus was born.

Jail no disgrace

Some agents on the reservations wisely took advantage of the fact that Indians had always had judges, and accordingly drew the arbiters of the reservation court from the native ranks. There were, of course, agents who refused to appoint Indian judges and who heard and decided all cases without native advice. That this did not work out so well in many cases was probably due to the differences of opinion that lay in the two conflicting culture backgrounds, rather than in differing capacities for administering justice. For example, most Indians of that day put far less value upon time than the white man. A week or a month meant little to the former and a great deal to the latter. A jail sentence for an Indian might easily mean better food than he got at home and freedom from all responsibility of providing for his family. In old times Indians were punished by destroying their property, by cutting the tails of their horses as a badge of disgrace, and sometimes by whipping them with horse quirts. But the accompanying disgrace and ridicule engendered by each and all of these were the real penalties. The jail, on the other hand, was merely a white man's house, and so carried with it no traditions of disgrace. Of course, in time the Indians came around to that point of view, but even now to many Indians a jail sentence does not mean the same thing as it does to a white man. And if anyone should wonder at this, let him not forget that it took centuries to condition white society to abhor the jail.

The Agent rarely knew enough about Indian life to understand any of these things, so one can imagine what tragic mistakes he might make when judging cases without the advice of responsible Indians. As a rule intelligent Indians knew a great deal about the ways of white people and so would have judged many white offenders justly, whereas most agents would have made themselves ridiculous dealing with Indian offenders. Of course, if he possessed the proverbial wisdom of Solomon, an agent might get along without Indian advice, but many stumbling blocks would lie in his path, not the least of which would be the problem of language.

A humorous mistake

Every now and then, these language difficulties would work to the advantage of the Indian, as in the amusing incident once told me about two Indian men who amicably exchanged wives. All parties to the trade seemed pleased, but according to white law this was a serious offense. So they were arrested and ordered to assume their former relationships. When they refused to comply, the Agent conceived a good punishment would be to lock up each man with his original wife. But what actually happened was that the Agent got things mixed up in his struggle with the language and locked up the men with their new partners instead of with the old ones. It was great fun for the Indians, who kept it to themselves. The erring couples were released from jail some weeks later after promising to live together in the future. No doubt this agent congratulated himself on his ingenuity and the success of his original method for the reconciliation of estranged couples.

These incidents are not given to create the impression that when an agent decided to be the judge he invariably made a mess of it, but because no one cares to hear about the uniform and wise decisions many of them handed down. In any case, the government expected the Agent to review the decisions of his judges and revise them if necessary. This had the additional virtue of providing a method of appeal when Indians felt they had not received justice in their own court. We note in the official reports that some agents complained because the decisions of judges were too harsh. For example, the verdict might be a long jail sentence, whereas the Agent thought a short one sufficient. Yet a wise Agent was sparing in his review of cases, otherwise the morale of the judges would weaken.

There was one thing, however, that every agent insisted upon: that the judges cut their hair short. Some time previous to my visit, an order had gone

out from Washington that no Indian could be employed by the government nor elevated to office until he visited the agency barber. Not only was his hair to be cut short, but cut in the prevailing white style and kept cut. Such an unreasonable decree caused endless strife, of course, and benefited no one but the barbers. But agents taking the hint, filled their reports with statistics of so many haircuts, proud of having used force to bring about this reform. When an Indian was so unfortunate as to be arrested, the barber was promptly called in to cut off his glorious black hair.

Why the government should have set itself so uncompromisingly against male long hair, I do not know, unless the why for this fanaticism lay in the fact that long hair stood before the white mind as defiance of paganism against Christianity. I suppose all long-range government is stupid, but what could be more inconsistent than to demand that all police, judges, and other Indians loyal to the United States should cut their hair and then at the same time impose this indignity upon the criminal and thus give it the quality of a social stigma? At the time, I should have liked to know what the judges thought about this, but later happenings convinced me that they had become reconciled to such inconsistencies.

In exception

One case where the haircut rule was not enforced stands out in my mind. This exception occurred in an agency where two Indian boys about twelve years old had committed a theft. In the trader's store there was a showcase containing chewing gum and candy from which on occasion these boys were given a treat. But these were rare events in their none too exciting lives. Since burglary was an almost unheard of crime at the agency, windows were seldom locked, and so it was easy to steal a few handfuls of chewing gum. The two boys were quickly apprehended, convicted and condemned to labor on the agency driveway. I pitied these poor youngsters, doggedly hacking at weeds with hoes too large for their strength. How their muscles must have ached and their blistered hands stung when at night they curled up in the lonely lockup! I was interested to observe that each wore long braids of hair, and, on inquiry, learned that the Agent had been humane enough to order that the usual haircutting be omitted. This was one of the finest things I ever heard about that agent.

Although the Indian judges I saw in court looked more at ease than most Indians trying to conform to white ways, I could not escape the feeling that they would have been happier sitting on the floor

as they did in their homes. Of course, here again, Washington and the Agent would have been horrified at the idea of a judge so seated, but I suspect that the defendant up for trial would have been more impressed, and at least have felt that the gods of his fathers were sitting with the judges. However, it was in such outward inessentials only that Washington could work its will, for none of these judges spoke English. They conferred in their tribal tongue and questioned the prisoners and witnesses in the same. Of law books they knew nothing, but they did know that their people were still enmeshed in tribal customs, and that the moral status of their people must be preserved or at least slowly eased over into white social patterns. They had taken an oath to perform their duty and they understood their responsibilities.

But let us return to the court; the judges are sitting. An Indian policeman presents a clownish-looking Indian whom I suspect of being near the feeble-minded level. The judges ask the policeman why he arrested the prisoner. The statement is brief enough, merely that the prisoner rode into the agency at a gallop, shouting war cries, saying he had something to tell the Agent. The policeman knew a drunk when he saw one, so he ignored the message to the Agent and put the hilarious fellow into the lock-up. Signs of recent operations by the barber are noticeable.

The defendant's own version

One of the judges asks the prisoner what he has to say for himself. As I shall need to remark more than once in these narratives, the Indian's mode of discourse is different from ours; if one chooses to speak for an hour, no one interrupts. The judges usually respected this custom so long as the speaker seemed to be honestly trying to give the information desired. In this case, the speaker was perhaps insincere, because he told how, when riding toward the agency, he saw a bottle in the trail containing something suspicious, but that he rode on. Then it occurred to him that it might be whiskey, which some Indian would find, drink and get into jail, so his duty was plain. Returning, he picked up the bottle, intending to take it to the Agent. However, as he rode along there came to him the thought that the bottle might not contain whiskey, so he pulled the cork and sniffed. Yes, it smelled like whiskey, so he replaced the cork and rode on. Later came the idea that other liquids might smell like whiskey and yet not be whiskey, in which case the Agent would ridicule him. (No people can be more sensitive to ridicule than Indians.) Naturally the bottle was opened

once more and a swallow taken. Again he said this certainly is whiskey, and should be taken to the Agent at once. Yet as he rode on he did not feel as if he had had a drink, perhaps, after all, this was not real whiskey. So he took another pull at the bottle and was soon convinced, for now he was feeling fine. He whipped up his horse and headed for the Agent's office. He said he had done his best and almost got to the Agent before the police stopped him. Neither the judge, the policeman nor the few other Indians waiting around showed any change of countenance during or after this long narrative, which was at times enlivened by good and even humorous acting.

The judges sat silently for a brief interval as if to make sure the prisoner was through, then went into a brief huddle, after which one of them uttered a few words which the interpreter passed to the clerk as "Three weeks."

The most important aspects of all courts are the personalities who sit on the bench. This is probably true for all grades of society, including Indian reservations. I soon learned that my best chance for enlightenment on aboriginal life was to sit at the feet of the men who sat upon the bench. So I made it a rule to cultivate the friendship of these judges, and had little difficulty in winning their respect. On one reservation three judges were unusually helpful, and even spent part of their time between cases planning my next lesson in tribal customs and history. Their chief concern seemed to be that what they handed on for the written record should be correct to the smallest item. It was an inspiration to work with them, and as my day of departure approached, there were regrets on all sides—there was still so much to learn. My obligations to them were so great and my appreciation of their personalities so real, that I sought advice as to how, in keeping with the dignity of their position, I could do something adequate to the time and place. A wise trader suggested giving the judges a dinner. As this seemed by far the best solution, invitations were extended and accepted by their Honors, Pine-tree, Four-guns, and Running-wolf.

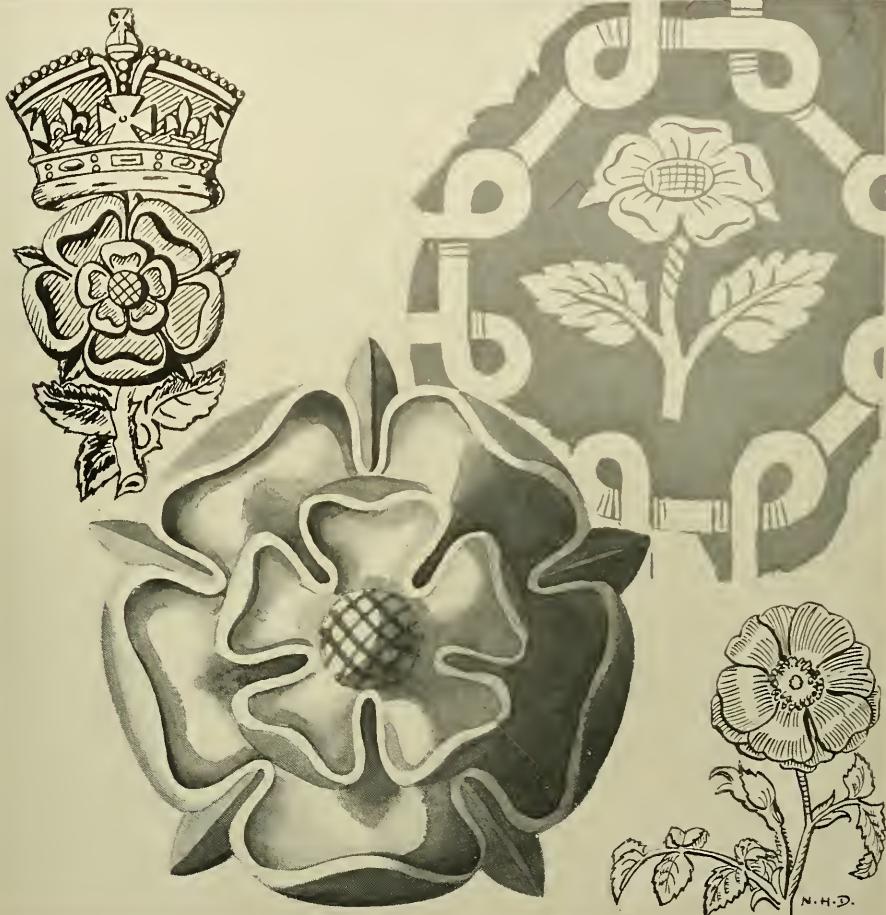
In Prince Albert coats

At the appointed time the first to arrive was Four-guns. I had been mildly surprised by his civilized apparel and that of his colleagues in court, but that was no preparation for the dignified figure I now beheld resplendent in a Prince Albert coat, white tie, spotless creased trousers, shiny shoes and carrying a gold-headed cane. I had never seen a red man look so stately and correct. Next came Pine-tree, shorter in stature, a bit jerky in manner, but

Continued on page 298

FLOWERS AS NATIONAL EMBLEMS

By NATALIE HARLAN DAVIS



PERHAPS the most intimate way in which the natural history of a country shows its influence on the thought and artistic expression of its people is in their selection and idealization of a national flower.

National flowers are not born full-blown in the traditions of a people but enter their art and culture gradually; hence it is chiefly among the older countries of the world that we find abundant lore and legend surrounding them.

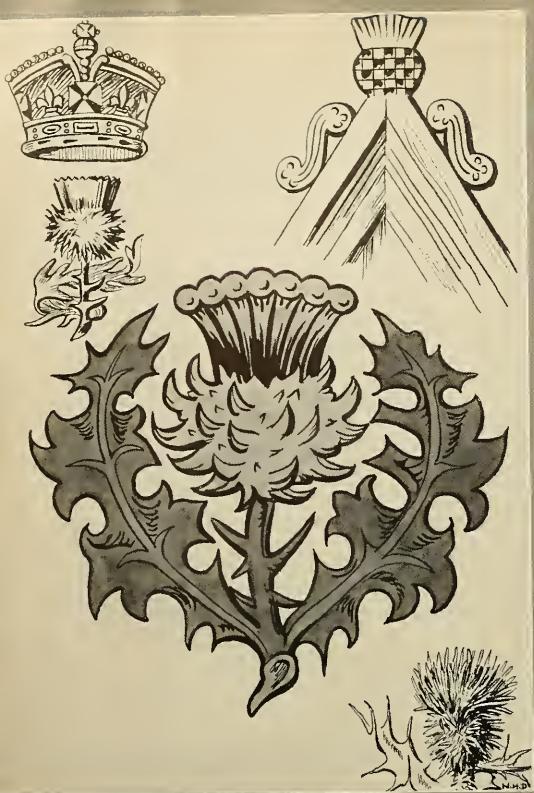
All the national flowers cannot be included in this series, but those represented are among the most celebrated.

The United States is not included because there exists no national unity on the choice of a flower.

ENGLAND The Rose has been the national emblem of England since the fifteenth century, when Henry VII, trying to unite the warring houses of York and Lancaster, united their badges of the white and the red Rose, the white within the red, and this became the Tudor Rose. The crowned Rose is the badge of England today.

The design became very popular and was used in architectural ornament, in furniture, tapestry, armor and stained glass. At upper right is shown a fragment of an Elizabethan wall-paper with the Rose motif.

A Rose from an old herbal (*lower right*) shows that the cultivated flower was still very like a wild rose.



SCOTLAND The wayside Thistle, symbolic of the courage and strength of the Scots, is said to have become the national flower because its sharp barbs saved a battle for Scotland. According to the legend, a party of invading Danes, attempting a surprise attack on the Celts, crept up on their sleeping camp in the dark. Suddenly a Danish soldier trod with his bare foot on a Thistle. His outcry warned the Celts, who won the following battle. The same story is told in connection with Robert Bruce, when he was being attacked by the English.

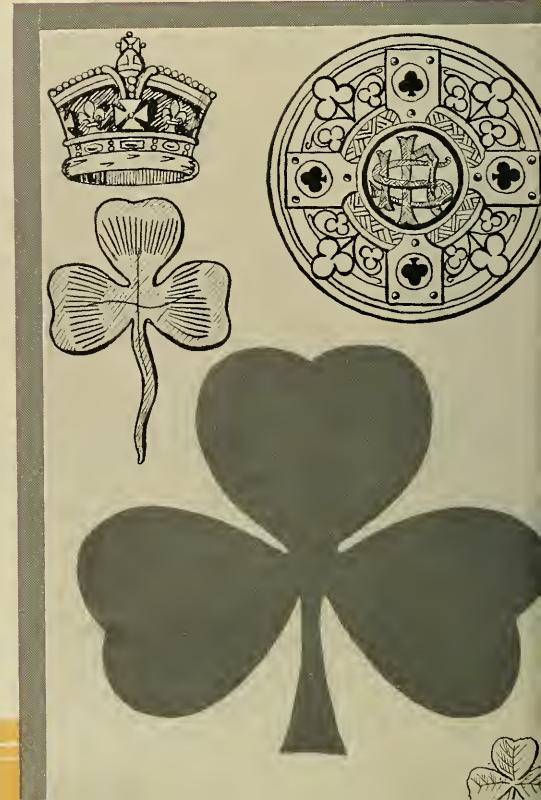
The Thistle, with its bold motto: "Whau daur meddle wi me?" appears on flags of old Scottish regiments. It was used on coins in the fifteenth century, and in the decorative arts. Its use in architectural design is illustrated at upper right by an ornamental window heading. The crowned Thistle is still the national badge of Scotland (*upper left*).

The Shamrock is said to have **IRELAND** become the national emblem of Ireland because St. Patrick, preaching one Easter day, used it to demonstrate the doctrine of the Trinity.

"Is it not as possible," he asked, as he picked a Shamrock, "for the Father, Son, and Holy Ghost to be one, as for these three leaves to grow on a single stalk?" Then were the Irish convinced, says the story, and were straightway baptized.

The Shamrock was henceforth considered a holy herb (*Herba Trinitatis* is the old name for the trefoil), and, too, it was made in the sign of the cross. So it was worn by rich and poor, peasant and knight, as a charm against evil; and according to legend, it was with the Shamrock that St. Patrick drove the snakes out of Ireland.

It is shown at upper right in the design of an old ecclesiastical ornament. The crowned Shamrock is still the heraldic badge of Ireland.



The Leek, national emblem of **WALES** Wales, is said to date from the time of St. David. One legend says that when the Britons were at war with the Saxons, St. David directed the Britons to wear Leeks from a nearby field in their caps, to distinguish them from the enemy. To celebrate the great victory that followed, the Leek became the national emblem. Another account says it was simply because the meadow Leek and river water were the only food of St. David when he withdrew from the world for prayer and study.

Lately there has been some effort to replace a vegetable with a flower, as national emblem. It was said the Leek was a natural mistake that had been perpetuated because Leek and Daffodil come from the same term, Cenin. That also few Leeks grow in the north of Wales, while the Daffodil grows everywhere.

Both Daffodil and Leek are now worn on St. David's Day.

The central emblem at right is the one worn on the caps of the Welsh Guard. Above is shown the use on the arms of a county in Wales.



UNITED KINGDOM

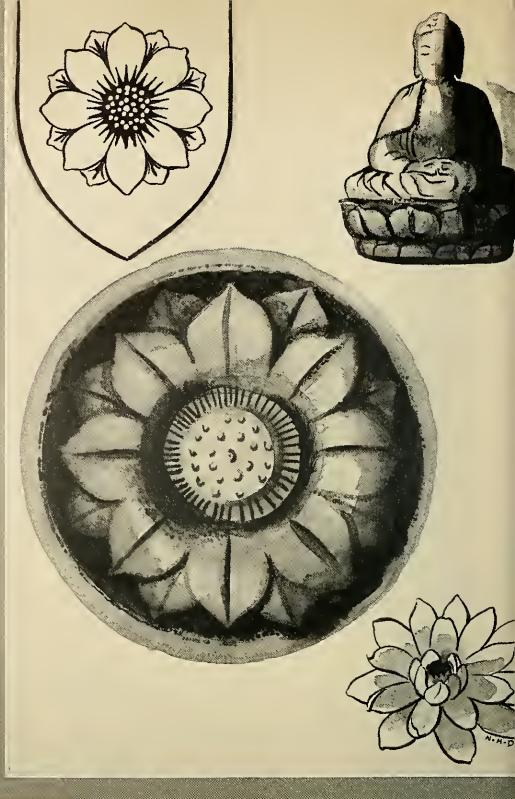
The Thistle, the Rose, and the Shamrock, united under the crown, has been the emblem of Great Britain since an Order of the Council made it the badge of the United Kingdom in 1801. It is still worn on the breasts and backs of the "Beaf-eaters," the Yoemen of the Guard and the Yeomen Warders of the Tower.

Badges, important in feudal times, were worn by servants and retainers of important personages, unlike the coats of arms and crests which were worn by the latter on helmet, shield or surcoat. The badge was always a simple symbol, easily recognizable, a flower, animal, or household object. The first of these badges to become important was a plant, the sprig of broom plant (*planta genista*), which gave rise to the name Plantagenet. Next came the white and red Rose of York and Lancaster, then the Tudor Rose. Queen Anne united the Thistle with the Rose on her seal. Finally Queen Victoria incorporated the Shamrock in her royal diadem in place of the fleur-de-lis.

The Lotus, emblem of India as it is of Egypt, is full of religious significance, as well as national association. The flower is identified with the sun, and is believed to signify the mysterious sanctuary into which the sun returns every evening, there to gather fresh strength.

According to Hindu myth, before the creation of the world there existed an immense sea. On this vast water moved the spirit of Om, supreme being, which quickened into life a golden Lotus, from which emanated the god Brahma, who by the light of his countenance dispelled the gloom and evoked the earth into being. Buddha, who like Brahma is believed to be a lord of the universe, is usually represented seated upon a lotus (*upper right*).

Each part of the flower represents some sacred being. The center, or seed-pod is Vairocana, source of all organic life; and the eight inner and outer petals all have special deities. The flower is engraved on the hands and placed behind the heads of Hindu gods, signifying world sovereignty. The Lotus design, the full-blown flower, is used again and again in Indian art and architecture, and as a national emblem it appears on the coat of arms of important personages connected with the country.

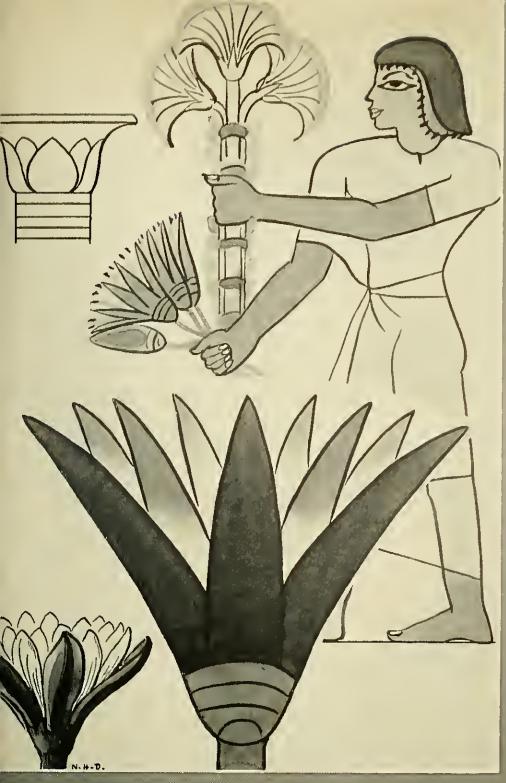


CANADA Maple Leaves became the emblem of Canada, because they were once a protecting camouflage to her soldiers. In the War of 1812, when the English were fighting the French in the woods, they tried to conceal their scarlet uniforms by slitting their tunics and inserting sprays of Maple Leaves; this enabled them to move forward partially concealed.

Fifty years later the British Government placed the device of three Maples Leaves on the regimental colors of a Canadian corps called the Prince of Wales Regiment; and when the Prince, later Edward VII, visited Canada, at a parade and reception given in his honor all native Canadians were asked "to wear the Maple Leaf, as an emblem of the land of your birth."

The three Maple Leaves appear on the arms of the provinces of Quebec and Ontario, as well as on that of the Dominion of Canada, and it was the badge of the Canadian Forces during the World War.





EGYPT The Lotus has long been accepted as the national emblem of Egypt, but to the ancient Egyptians it had a deep-rooted religious significance. Its universal use resulted from its symbolic association with the Nile as the giver of Life, and the spiritual meanings associated with it include fecundity, resurrection, and immortality. Bouquets of the Lotus were given guests at funerals, and the flower itself is represented as a common votive offering and is frequently painted as though tied on to shrines or house pillars.

The human figure, typical of many, is from a mural decoration from a tomb at Thebes. The conventionalized flower, which is a half-opened bud, is used over and over in Egyptian decorative arts and architecture.

It was also a solar emblem perhaps because it opens and closes with the rising and setting of the sun. An ancient Egyptian text says: "The sun, which was from the beginning, rises like a hawk from the midst of the Lotus bud."

The Egyptian Lotus is a water-lily (*Castalia Lotus*) and its use in art dates from at least 5000 years ago in Egypt. Through general conventionalization it became one of the most prolific ornamental forms, entering the art of other countries.

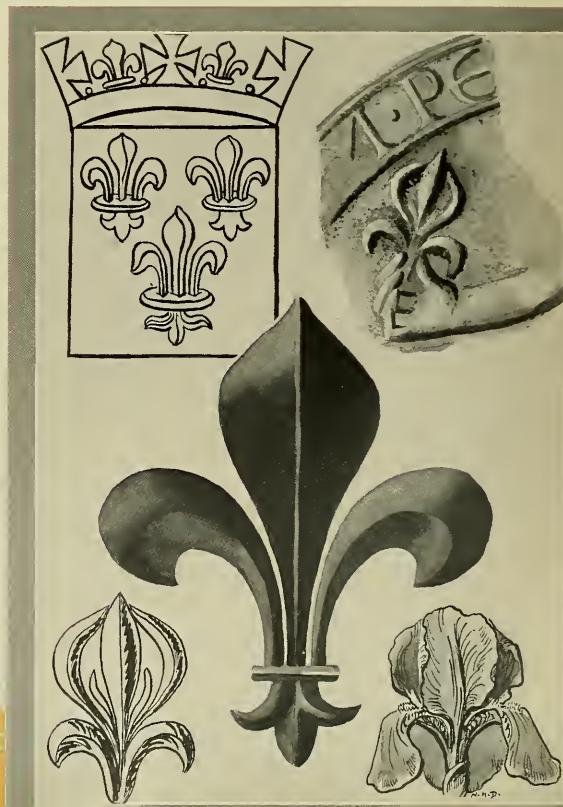
The source of the Fleur-de-lis, **FRANCE** beautiful emblem of France, has long been disputed. Some say it was taken from the lily, others the iris.

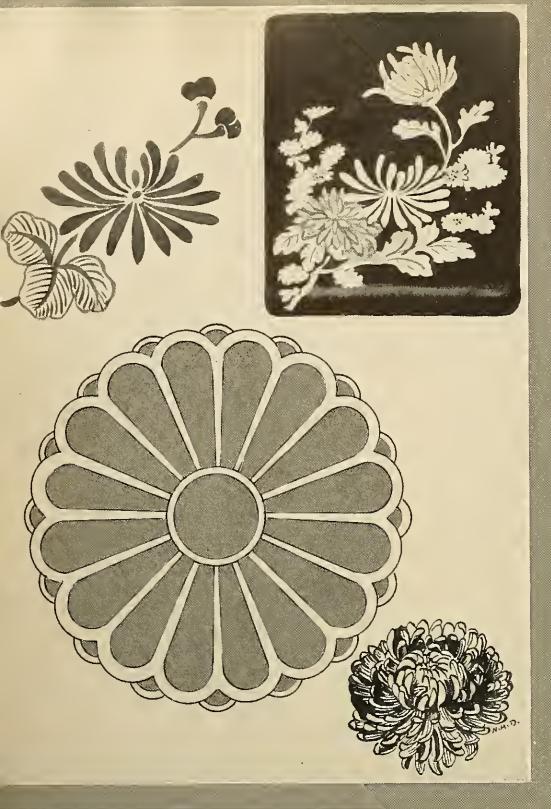
The shape of the flower on the fragment of a seal of Louis VIII (upper right) seems to point to the iris.

One legend says it was first used in remembrance of the fatherland of the Franks, who, when they proclaimed a king, elevated him on a shield and placed in his hand a blooming iris or marsh-lily, instead of a sceptre.

Louis VII was the first to use the device on the national coat of arms, and Charles V used the three Fleur-de-lis (upper left).

Since then it has been used in more than a hundred different shapes as an emblem of France, wrought in the crowns, woven in the robes, and carved on the tombs of her kings.





JAPAN The Chrysanthemum is not only Japan's national flower, it is the Imperial standard and crest of the Mikado, adopted by Emperor Kwannu in the eighth century when the flower was first introduced into Japan through Korea.

It found such popularity that the Chrysanthemum motif in many forms was used in textile designs, on porcelains, bronzes, lacquer-ware (*upper right*), and sword hilts; but this conventionalized design of the sixteen-petaled flower in gold on a crimson ground was permitted only to royalty.

It is still Japan's favorite flower, and over 800 varieties have been produced in over 250 shades of color. A Chrysanthemum festival is held each year to celebrate the Emperor's birthday, at which petals of the flower are placed in *sake* cups, insuring long life and happiness to the drinker.

Though not a formal emblem, the Tulip, as national flower of Turkey, appears in all of their decorative arts. While the Tulip is a favorite motif in all Near Eastern art, probably originating in Persia, the Turks are especially devoted to this flower that makes brilliant their countryside in certain sections.

As early as 1700 thousands of varieties of Tulips were known to be cultivated; but unlike many of our varieties, the pointed petal was always insisted on in Turkey.

Those shown are from old tiles and other ceramics.

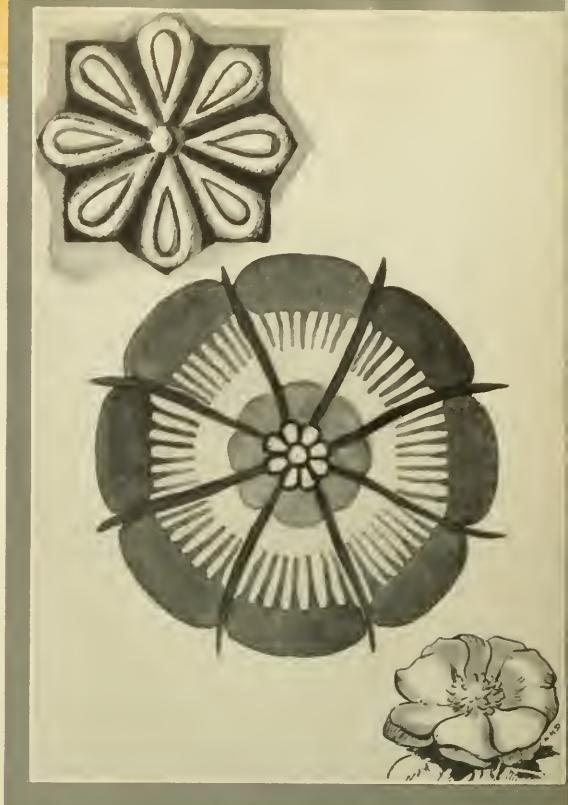


In Persia, which is known as the **PERSIA** land of Roses, the Rose flourishes in great beauty and is highly prized, and this probably accounts for its selection as national flower. At one period a Festival of Roses was held, lasting the entire time that Roses remained in bloom.

One of the most famous Persian books is the *Gulistan*, or Garden of Roses. The author, Sadi, was once a slave, and the story tells that one day he presented his master with a Rose, saying:

"Do good to thy servant whilst thou hast the power, for the season of power is often as transient as the duration of this Rose." This speech is said to have won him his freedom.

The Rose motif is used in many forms in all Persian ornament. Those shown came from a textile and from architecture.



SPAIN The Pomegranate, symbol of fertility and abundance, is obscure in its origin as emblem of Spain. It was used on the arms of the Kingdom of Granada, and at the capture of Granada the Pomegranate was added to the arms of the Kingdom of Spain.

Katharine of Aragon used it as her emblem, and at her marriage Henry VIII combined the Pomegranate with his badge of the Rose.

Philip II of Spain, referred to his emblem of the Pomegranate, and is said to have wished for as many faithful friends as the Pomegranate had seeds.

The Pomegranate has figured in the architecture and decorative arts of many countries, from Solomon's temple until the present day; but up to the present war it was considered the national emblem of Spain.

A TICKET TO THE ARCTIC—*Is the Arctic accessible only to professional explorers? Here is proof that anyone can indulge his scientific hobbies on an enjoyable summer vacation in the Far North*



Photo by George M. Douglas

(Above) Tied up to the shore to take on cord-wood: a typical, picturesque stern-wheeler plying the Mackenzie River system, by which the traveler can journey at his leisure right to the Arctic Ocean.

TO THE ARCTIC BY RIVER BOAT

Trappers, prospectors, missionaries, government officials, and an increasing number of serious-minded tourists travel to outposts of the Arctic frontier on these boats or by the elaborate system of airways

By RICHARD FINNIE

THE average citizen of the United States still thinks of Canada as a cold and rough country, and Canada tends to foster that idea in tourist publicity by stressing winter sports and backwoods atmosphere.

An old Vermonter once told me he supposed the temperature in Ottawa must be unbearable when it was 40° below zero in his home town of Woodstock, assuming that the farther north one went the colder it would get.

More and more Americans are visiting Canada each year, however, finding that particularly in summer Canada can be very warm indeed, and that even

in winter some sections of Canada enjoy a more moderate climate than do some sections of the United States.

While my Vermont friend might accept the statement that Ottawa's minimum temperature is probably about the same as Woodstock's, altogether too great a strain on his credulity would result were I to add that at a trading post called Fort Hearne over 100 miles north of the Arctic Circle the lowest reported temperature is but ten degrees lower than that at Woodstock. But just the same, even Arctic Canada is not nearly so frigid as it is popularly thought to be, nor is it so inaccessible.

I wonder what my Vermont friend's reaction would be if I suggested to him that for his next va-

cation he *buy a ticket to the Arctic!* Yet that would not be so absurd as he might think, for today he could do just that: buy a ticket and travel in comfort by established commercial lines of water or air to and from almost any part of the Canadian Arctic. Farther on in this article I am going to tell him where in the Arctic he might go, what it would cost him, what he should take with him, and what he could see.

Unlike most vacation trips, a tour of the Arctic will give you the satisfaction of seeing sights which relatively few other people have witnessed and—if you are camera-conscious—of photographing scenes that are not thrust under your nose by post card vendors. Many of the diversions of an unofficial “expedition” to the Arctic may easily develop beyond the hobby stage, for if one is interested in collecting flowers (there are hundreds of species in the Arctic), mosses, lichens, insects or native art, he may well acquire specimens which will interest his local museum. Advice may well be sought beforehand on the technique of collecting and the type of material most wanted. Individual doctors have already carried out valuable research among the Eskimos. One medical man from England made it his problem to ascertain the blood grouping of the natives, which has a bearing on their racial affinities. Another investigated the Eskimos’ susceptibility or immunity to various diseases—and even to poison ivy! Valuable studies in pulmonary susceptibilities could be made among the Eskimos, also in the so-called childhood diseases which sometimes rage with high mortality among primitive peoples not used to them. One dentist at least has made it his summer avocation to study the Eskimos’ teeth, which under primitive conditions are astonishingly sound but under civilized influences deteriorate badly. There are scores of problems which can be attacked as well by the individual as by an organized expedition.

Or the traveler may merely want to bring back an informative photographic record of a part of the world which few persons have opportunity to see, except on the screen. But if one is adverse to speaking in public, he had better keep his trip a secret, for the local organizations will surely be after him.

RICHARD FINNIE, F. R. G. S., was born in Yukon Territory within a stone's throw of the Arctic Circle, and in the course of seven expeditions has visited almost every section of the Canadian Arctic. These trips, which began when he was only 17, include a one-man expedition to the Western and Central Arctic, where he wintered with remote

and primitive Eskimo groups, and the first airplane flight ever made over the North Magnetic Pole. The latter achievement came in the course of a search for relics and data pertaining to the ill-fated Sir John Franklin Expedition. He has done work in cooperation with the National Museum of Canada, and has produced some 25,000 feet of motion picture film for the

Since the 15th and early 16th centuries, when a Northwest Passage to rich Cathay was first sought, men have been venturing into the Canadian Arctic, first in hope of traversing that elusive route, then to discover new land, to catch whales, to harvest precious furs or to locate even more precious minerals.

From the very beginning it seems to have been the fashion among Arctic travelers to play up their hardships (which have often been very real, especially in the old days) and to play down the pleasant features of their voyages; and withal to dramatize the awful barrenness and frigidity of the Arctic. The outstanding exception of all time is Dr. Vilhjalmur Stefansson, with his doctrine of the Friendly Arctic. Nor does the originator of this challenging phrase intend to give the impression that he is a veritable polar Paul Bunyan who could live off the fat of the land where ordinary mortals would soon shrivel up and perish. A careful reading of his books will show that he regards the Arctic really as neither friendly nor unfriendly, but rather as just another part of the world whose climate is rigorous yet salubrious, not lethal; where Europeans—normal men and women—may lead useful, happy lives if they make full and intelligent use of the accumulated knowledge of it, combining the advantages of civilization and science with all the lore of the aborigines, and are temperamentally adaptable.

But the man in Vermont is not planning to make his home in the Arctic (the very thought of it would chill his spine). We only propose to send him there for a summer vacation.

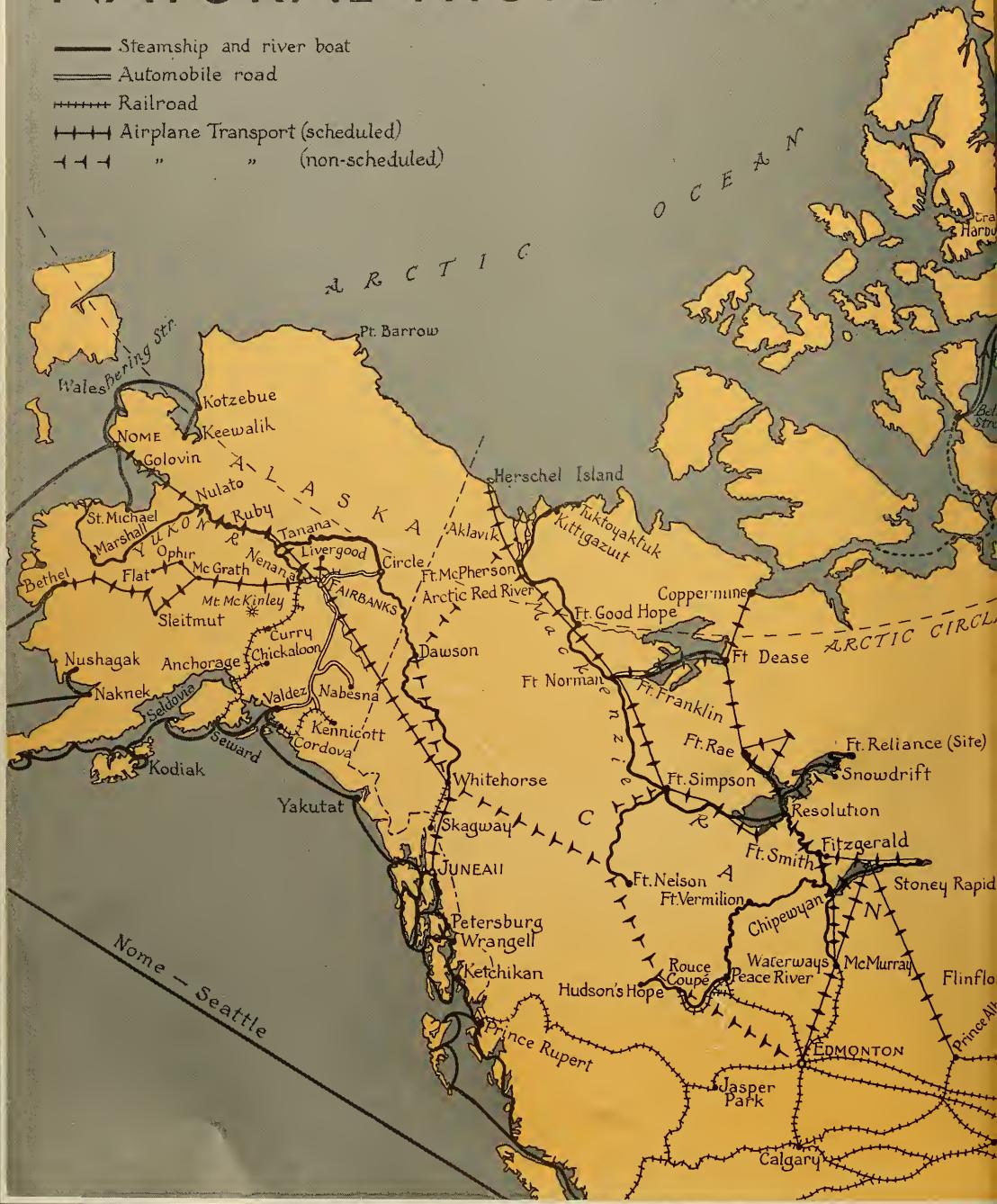
He has, of course, heard of tours to Alaska, which for years have been more or less standardized; and nowadays he could go there by steamer, then visit various inland towns and villages by train, boat or airplane. In a little while, when the projected British Columbia—Yukon highway is built, he may drive all the way in his own automobile. While Alaska and Arctic may at times be synonymous in his mind, he is not inclined to think of the tourist's Alaska as being quite Arctic, yet much the same general conditions as to weather and travel obtain there as in the contiguous Yukon Territory and the adjacent Western Canadian Arctic—but the latter is still

Canadian Government, comprising ethnographic studies and official records of polar expeditions. Having traveled by boat, dog team and airplane almost as widely in the Canadian Far North as any other human being, he is particularly well qualified to write on the facilities discussed in the present article.—THE EDITOR.

NATURAL HISTORY'S MAP

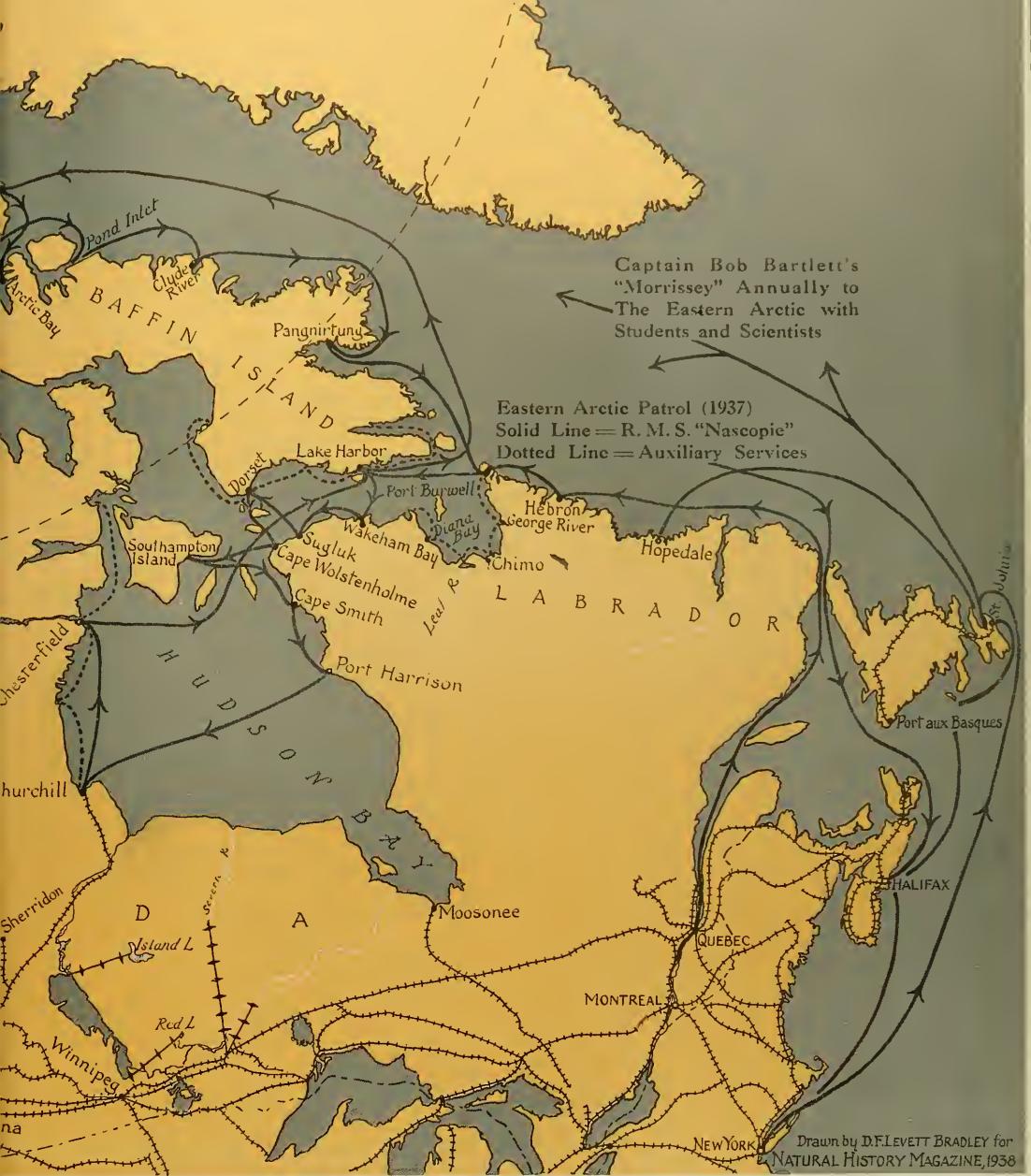
North Pole

- Steamship and river boat
- Automobile road
- Railroad
- ||||| Airplane Transport (scheduled)
- ||||| " " (non-scheduled)



OF ARCTIC ROUTES

This map was compiled from the most reliable sources available, but it does not perhaps contain all possible routes



just "snow and ice" to him and to the public at large.

After 1789, when intrepid young Alexander Mackenzie paddled more than fifteen hundred miles down a mighty river system then unknown to white men and wound up at the Arctic Ocean, civilization has slowly but persistently pushed northward in his wake, entrenching itself with trading posts and missions. Some of the Klondike gold-seekers trekked down the Mackenzie River during the rush of 1897-98. But within the past eight or nine years, startling mineral discoveries have accelerated development and improved transportation facilities so that the whole Mackenzie River District has become accessible winter and summer by boat or plane. But it is the airplane, stimulated by the lure of mineral wealth, that has cracked open and "unfrozen" the Frozen North.

The opening of the Arctic

Hundreds of people, the majority of them traders, trappers, missionaries, Royal Canadian Mounted Policemen, Government administrators, and prospectors, troop in and out of the Mackenzie District each summer, and with them an ever increasing number of journalists and plain tourists.

Two of Canada's governors-general have already visited the Mackenzie District—first the late Baron Byng of Vimy back in 1925, then Lord Tweedsmuir (John Buchan) in 1937—along with other people of note, all of whom have spread the tidings that you don't have to be a blizzard-fighting explorer to see the Arctic any more. Indeed they have lent a certain social tone to Arctic holidaying, making of it something of a Thing to Do. The tourists attracted to the Arctic, it should be pointed out, are not the sort who litter camping places with tin cans and papers but, rather, serious-minded well-informed men and women who have already traveled a good deal. Most of them are worth meeting.

But more twiddle-twaddle has been printed in newspapers and magazines about the Arctic than about any other part of the globe, it seems, and as a result Northerners are prone to adopt a cynical attitude toward the outsiders who come their way—especially those who write. The true veterans that one meets, however, while they may be cynical, are nevertheless good-hearted, almost invariably hospitable, and are willing to accept a stranger at his face value.

The Canadian Northwest Territories comprise somewhat over a million square miles, contain about two score of scattered white settlements, a thousand white men and women, four thousand Indians and as many Eskimos. Present main occupation of all

natives: hunting and trapping; and of most whites: trading or trapping, latterly prospecting. The western division, of which the Mackenzie District takes in over 500,000 square miles, is more readily accessible the year round than the eastern, which, split into Keewatin (mostly mainland) and Franklin (islands), takes in part of the Hudson Bay country and all of the Arctic Archipelago.

We might initiate our Vermonter into some of the mysteries of the Arctic by first sending him down the Mackenzie River.

He will journey by rail or motor car to Edmonton, capital of the social-credit province of Alberta, the most northerly city in the Dominion (population 80,000), an outfitting center for traders, trappers, and prospectors, and the jumping-off place for the Western Arctic. Thence he proceeds by rail or air to Waterways, 300 miles beyond, which is the "end of steel." This will cost about \$25, either method. From Waterways he may continue either by plane or picturesque paddlewheel steamer right to the Arctic Ocean. A round trip on a boat costs about \$325, takes a month. A round trip on a plane would cost an additional \$100 or so, exclusive of living expenses, could be done in three or four days including stopovers for eating, sleeping and sightseeing. An ideal arrangement, especially if his time were limited, would be to go north by boat, absorbing atmosphere for a fortnight, then to retrace the route by air, the combination price being \$420.

Alternatively—but reservations must be applied for well ahead of time—an airplane could be made available at Aklavik on the arrival of the river steamer *Distributor* about the end of June or, for a later trip, at the end of August to carry passengers to Dawson. This means that it would be possible to journey to the Mackenzie Delta by boat, then by plane to Dawson and from there by boat or air via the Yukon River, White Horse and Skagway to Vancouver; or the circuit could be made in the opposite direction. The fare from Waterways by boat to Aklavik, including berth and meals, and by air to Dawson is \$875 for two persons, 100 pounds of baggage being carried free. The Dawson-Vancouver fare is extra. It is scarcely nine years since the first flight was made from Aklavik to Dawson, and while northern pilots now take such a hop as a routine assignment it should thrill any tenderfoot. The price is fairly high but so is the latitude! In the Far North gas, oil and all other imported commodities are expensive.

Good flying country

Be our Vermonter prejudiced against air travel he will be reassured to learn that since the first air-

plane droned down the Mackenzie some seventeen years ago, in all of the score of millions of miles flown throughout much of the Canadian Arctic and sub-Arctic—often over vaguely charted country, with makeshift bases, sporadic fuel caches, and no radio direction-finding aids whatsoever—there have been few crack-ups and not a single paying passenger has been killed. Not only to the fact that most of the North is good flying country, honeycombed with lakes and rivers where emergency landings may be made, with floats in summer and skis in winter, is this phenomenal record attributable, but also to the fact that Canadian pilots and air engineers are unequalled anywhere in skill and sound judgment and reluctance to take unnecessary risks. Paradoxically, whereas in urban areas flying is still looked upon as a hazardous enterprise, in the wilderness and tundra of the Far North the airplane has become as commonplace a means of travel as the canoe and dog-sled. The two foremost flying companies operating regularly in and out of the Northwest Territories are Canadian Airways Limited and Mackenzie Air Service Limited; both have done splendid pioneering and exploring, as have some of their competitors; and it was from Canadian Airways that Lincoln Ellsworth chose two men to fly him over the South Pole.

Along the Mackenzie River, which is open for navigation from June until the beginning of October, our Vermonter will be harassed by unconscionable swarms of mosquitoes, bulldog flies and, later, black flies; he will be intrigued with century-old trading posts still doing business, he will inspect schools and hospitals for Indians, most of them staffed by priests and nuns; he will fall in with fellow travelers among whom will be colorful traders, trappers, missionaries, Mounted Policemen and prospectors; he will see the Chipewyan, Yellowknife, Slave, Hare, Dog-rib and Loucheux Indians living in log cabins or in tepees, clustering to receive their annual Treaty Money from the Government (if he comes along at the right time), and watch their marathon drum-games.

Wild life

He will see thousands of ducks and other waterfowl which breed in the Far North, will photograph and hear about the moose and caribou and other game animals roaming the bush, but he may do no hunting (even if it were in season), unless he has a special collector's permit, for as a conservation measure hunting and trapping licenses are granted only to British subjects backed by four years' residence in the Territories.

At Aklavik in the Mackenzie Delta, far beyond

the Arctic Circle, he will see his first Eskimos, and there he may swim and be astonished to find that the water as well as the air is warm. He will call at the missions, the wireless station and the Mounted Police headquarters, and secure room and board at the local hotel where the proprietress will regale him with the story of her life.

He may take a side trip from Aklavik to Herschel Island, right on the Polar Sea, once the winter quarters of whaling ships; or over to Kitigazuit on the northwestern side of the delta, to see the famous reindeer herd that was driven from Alaska to become a new meat source for Canadian Eskimos.

Southward bound he may detour by air up the Bear River and across 12,000-square-mile Great Bear Lake to Port Radium or Cameron Bay, just below the Arctic Circle, to see in operation the richest mine in the world—where the fabulous pitch-blende that broke the Belgian Congo monopoly is taken out, concentrated in a modern mill and thence sent by air and water to railhead.

Mr. Vermonter may jump from there to Coronation Gulf—once among the remotest spots on the continent—to see the Copper or "Blond" Eskimos, about whom Stefansson wrote in his "My Life With the Eskimos." It will take him but a couple of hours to go there and return to Cameron Bay by plane, part way tracing the Coppermine River which, in 1771, was followed to its mouth by Trader Samuel Hearne, who thus became the first European to reach the Arctic Ocean from the interior.

Back from his summer's junket our friend will have acquired a new conception of the Arctic—of an Arctic where mosquitoes swarm, where the thermometer sometimes rises to 90 degrees in the shade, where tall trees grow, where vegetable and flower gardens flourish in the light of the midnight sun, where tractors, boats and airplanes are moving men and supplies to and fro, where civilization's last great frontier is being extended and consolidated with quiet determination by hardy modern pioneers.

Having shown him the Western Arctic, let us switch him to the other side and dispatch him just about as far north as he could readily go without aspiring to attain the Pole itself.

The Eastern Arctic

This time he won't be doing any flying. As yet commercial planes do not carry passengers on regular schedules to Hudson Bay or Baffin Island. Although prospectors' and even missionaries' planes are no longer unknown around Hudson Bay, none of them has yet touched Baffin or other islands of the Eastern Arctic Archipelago. No, he will buy a



(Left) ICE-FLOES, an Arctic novelty: passengers flocking to see almost the only ice encountered in the 12,000-mile cruise of the *Nascopie*, which carried both officials and a few passengers farther north than Baffin Island. So persistently have the grimmer aspects of the Arctic been stressed that few realize the pleasant opportunities it offers for travel and study (Photo by Richard Finnie)



Photo by Richard Finnie

(Above) A "BLOND" ESKIMO: a member of the Coronation Gulf group whose lighter skin caused much controversy subsequent to their discovery by Stefansson

(Left) RICHARD FINNIE recording one of his seven trips to the Arctic: on the Mackenzie River, the western gateway to the Canadian Arctic. Once traversed only by explorers, the Mackenzie River country is accessible the year around by boat or plane



STILL IN THE EXPLORERS' ARCTIC, Baffin Island has not been visited by planes and until recently was virtually closed to tourists. Above, a Mountie checks supplies brought by R. M. S. *Nascopie* (Photo by Richard Finnie)

(Right) NORTHWEST PASSAGE CORRIDOR: a lady tourist taking shore leave from the *Nascopie*, views the logical entrance to the goal of countless historic expeditions—Bellot Strait, between Somerset Island and the mainland

(Below right) To help found a fur trading post for the three-century-old Hudson Bay Company, these Eskimo families leave the *Nascopie* above the continent's northernmost tip. Note screen magazine, index of civilization's penetration

(Below) TOURIST WITH SOUVENIRS AND HEADNET. The latter protects against swarming mosquitoes of the far northern summers

All photos by
Richard Finnie



(Right) THE TRADING POST to be occupied by the three Eskimo families shown above goes up in one week on the eastern threshold of the Northwest Passage

(Below) ARCTIC FOX AND SEAL DINNER: taken only three feet from this ordinarily timid fur animal, the close-up is perhaps the only one of a wild, untrapped fox in existence



(Right) ARCTIC PICNIC on Baffin Island, showing that travelers taking the *Nascopie*'s annual 12,000-mile patrol voyage can enjoy themselves, explore a non-tourist-riden country, and indulge their outdoor scientific hobbies

(Left) AWAITING THE FREEZE-UP before discarding pontoons for skis. Planes have supplemented sleds and boats extensively throughout Arctic Canada and Alaska



(Right) AN AERONAUTICAL "DELIVERY WAGON" brings fresh lettuce to supplement Arctic foods. Here, at Great Bear Lake, a few vegetables are grown, but sub-Arctic dwellers rely mainly on the surprisingly efficient plane service. The pilots have a splendid record—no paying passenger has ever been killed

(Photo by Finnie)



Royal Canadian Air Force Photo

(Above left) HUNDREDS OF GASOLINE DRUMS await northward shipment at Fort Smith, showing how widely this fuel is used in the supposedly uncivilized Arctic and sub-arctic. When completed, the British Columbia-Yukon auto highway will increase this demand

(Photo by Finnie)



(Above) EL DORADO, famed radium mine on Great Bear Lake, as seen from the air. The mining camp is at center of picture on the shores of this 12,000-square-mile lake which is bisected by the Arctic Circle

(Left) "THE RICHEST MINE IN THE WORLD": a radium strike which dramatically broke the world monopoly held by the Belgian Congo. Here the precious pitchblende is unearthed, concentrated, then sent by air and water to railhead



(Above) SCHOONERS owned by opulent Eskimos: a scene at Herschel Island not far from the border between Alaska and Canada

(Right) 700 MILES NORTH OF THE ARCTIC CIRCLE, this tourist hailing from balmy Georgia is about to add Eskimos to his snapshot album. In the Arctic, the camera hobbyist will find subjects that few people have "shot" before him

All Photos by Finnie

(Below) FLASHY-HUED CALICO PULL-OVERS worn over the skin parkas are *le dernier cri* among these Herschel Island Eskimos. Many Arctic visitors make interesting studies of Eskimo life. Doctors find a wide range of opportunities to investigate native susceptibility; dentists may investigate the cause of Eskimos dental disintegration under civilized influences



round-trip steamship ticket from the historic Hudson's Bay Company. This will cost around \$650 and entitle him to a voyage of nearly three months and 12,000 miles, starting early in July from Montreal and ending at Halifax. (If he cannot spare the time for the complete voyage he may arrange to leave or join the vessel at Churchill, the Hudson Bay grain terminal, going to or from there by a railway connecting with Winnipeg.)

On the Royal Mail Ship *Nascopie* he will be given good food (fresh meats and vegetables) and comfortable quarters comparable to those of a trans-Atlantic freighter. This staunch 25-year-old ice-breaker provides the one annual contact with civilization for most dwellers in the Eastern Arctic. She carries freight for trading posts and has as passengers Hudson's Bay Company traders, missionaries, Government officials and scientists, Royal Canadian Mounted Policemen, and a very few tourists, men and women. Tourists or "guests" have been permitted on the *Nascopie* only within the past several seasons. Until then the Eastern Canadian Arctic was a region reserved exclusively for explorers and fur traders and the few other people who had definite business there. To tourists its door was virtually closed; and even today the facilities for their accommodation are so limited that reservations must be made long in advance.

Mr. Vermonter will find this trip different from his last. He will see a rugged, treeless Arctic, with icefloes, bergs, seals, walruses and polar bears. He will encounter Eskimos who, though having been in contact with white men for a much longer period than those of the Mackenzie Delta or of Coronation Gulf, are living more primitively or more squally. He will see a land that has changed little since it was first viewed by Hudson, Frobisher, Davis and Baffin. He will see the 268-year-old Great Company at work "on location"—discharging freight, with Eskimos, men and women, enlisted as stevedores; picking up hundreds of bales of the white fox pelts that are the very lifeblood of Eastern Arctic commerce. He will join in discussions among his shipmates about the activities and policies of the traders, the missionaries and the Northwest Territories administration, he will hear about and see evidences of the exploitation of the Eskimo by the whites, and he will form his own opinions and take sides.

To the Northwest Passage

He will see a score of outposts, including the most northerly post office in the British Empire, on Ellesmere Island, 675 miles inside of the Circle. He may go part way through the long-sought Northwest Pas-

sage, calling at Fort Ross, a new trading post at its key corridor of Bellot Strait.

He will remember this trip when other trips have long since been forgotten. Willy-nilly he will develop a real and abiding interest in the Arctic. And, strangely, while there he will read radio news bulletins with an ever lessening eagerness; the stock market, depressions and recessions, wars and revolutions will seem remote and only vaguely connected with him. Much more vital and important will be the rumors of a gold discovery in Baffin Island, the indications of a bumper fur crop for next winter, the price of foxes, the status of the Eskimos, or the prevalence of ice. For the Arctic is one of the few remaining parts of the world not torn by economic or political strife. Here is life in the raw, elemental and wholesome, real and simple. A trip to the Arctic is a perfect tonic for the tired business man, where his outlook becomes detached and where he may gain fresh perspective.

Equipment

For his Arctic travels our friend need take with him—besides still or movie camera and binoculars—an assortment of old clothes, sturdy boots, waders, raincoat, windbreaker and sweaters, and (particularly for the Western Arctic) a headnet and a mosquito bar. Adjuncts such as parkas, sealskin water-boots and other native gear (seldom really required) may, of course, be purchased in the country.

The average business man or woman with a broad and inquiring mind, with an appreciation of the ridiculous and an adaptable though not necessarily rugged physique can make of a holiday in the Arctic a pleasant and never-to-be-forgotten experience, but it becomes something even more worthwhile and purposeful if the traveler is a teacher, a doctor, a dentist, a writer, an anthropologist, a geologist or the like. Despite the march of progress and the work of countless expeditions, there is still a tremendous field there for competent research and investigation. The surface has barely been scratched.

It should perhaps be emphasized that these suggested trips demand no particular initiative or resourcefulness on the part of the tourist; they are taken via established commercial lines of transportation; the prime requisite is a ticket, and a substitute for the travel bureau cicerones will even be found in the aviators, boat captains or Old Northerners met with on the way.

But the man who is accustomed to roughing it, who can handle a canoe, a gun and axe, may go off the beaten track for a summer of active adventure in the Arctic or sub-Arctic. From one of the air com-

Continued on page 320

MOTHER BROWN BEAR CARRYING CUB

HAIRLESS, sightless and weighing only about a pound at birth, the baby bear is given the closest protection by its mother. The extraordinary photograph below shows a three-day-old cub being carried back home from a pool where its mother had gone for a drink.

Her refusal to leave her infant for a moment is explained by the fact that the father may become jealous, according to the authorities at the Whipsnade Zoo near London, where the animals roam in open ranges enclosed by ditches instead of bars



(Globe Photo)

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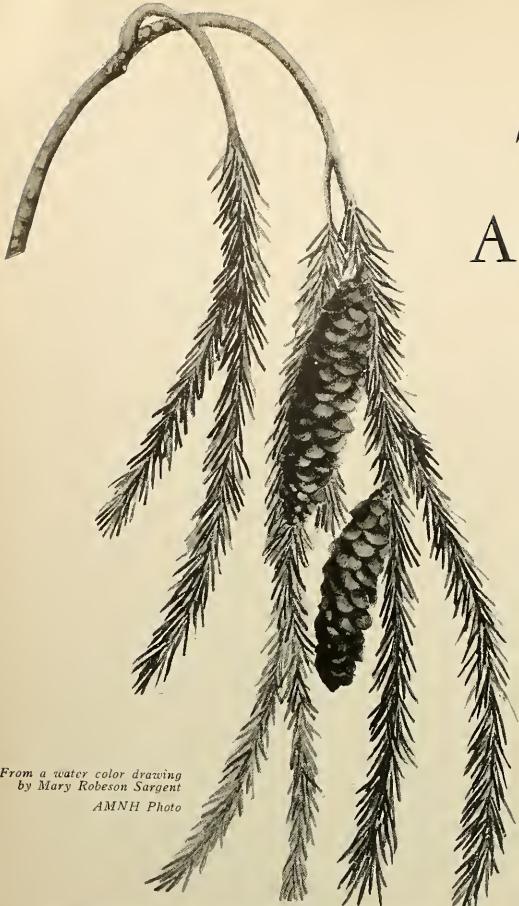
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The Rarest American Spruce

By C. EDWARD GRAVES

In the Salmon-Trinity Alps Primitive Area in northwestern California lies an extensive area of rough mountain country which in one respect is outstandingly different from any other spot on the globe. It is the home of the rarest American spruce, known botanically as *Picea breweriana*, or Weeping Spruce.

Like the California Sierras several hundred miles to the eastward across the Great Valley, this area is glaciated country, its granite outcrops polished smooth here and there by the movements of the great ice-fields, and its ice-dug depressions filled with the blue and green water of mountain lakes.

C. Edward Graves



From a water color drawing
by Mary Robeson Sargent
AMNH Photo



C. Edward Graves

The unfamiliarity of the Weeping Spruce is explained by its very limited range and the inaccessibility of its habitat. It is limited to mountain locations between 4,000 and 8,000 feet, does not grow north of the southwest corner of Oregon and is not found south of the northwest corner of California. It is thus confined to a north and south range of not much more than 100 miles and an even narrower east and west range, all very difficult of access. Once its habitat has been reached, however, the tree is found to be fairly gregarious.



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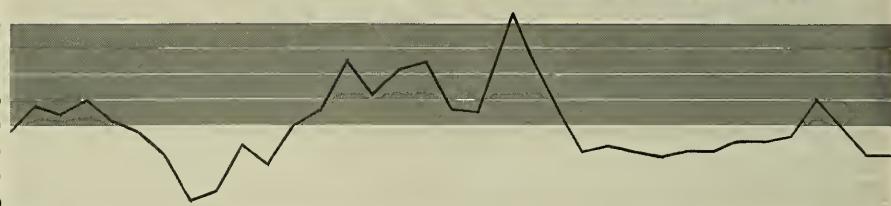
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It is referred to as a "little-known tree and a comparatively recent discovery" by George B. Sudworth in his comprehensive "Forest Trees of the Pacific Slope" published in 1908. He explains that it was permanently brought to light by Thomas Howell in 1884, although the man after whom it was named, Prof. William H. Brewer, a pioneer California scientist, collected a specimen in 1863 which was never completely identified because the cones were missing.

It is this tree that makes the landscape features of the Canyon Lakes district of the Salmon-Trinity Alps Primitive Area outstandingly different from those of any other similar mountain area in the world. Here the Weeping Spruce grows in profusion, by the trailsides, along the lake margins and on the mountain plateaus against a background of sternly forbidding rock ridges. The peaks are not as high as those of the Sierra Range, the highest, Thompson's Peak, being slightly under nine thousand feet, but they are just as rugged and spectacular, though on a smaller scale. Because of the difficulty of access they are comparatively unknown. Recent inclusion of the region in a Primitive Area of the U. S. Forest Service should give it the protection from future exploitation that it deserves.

The Weeping Spruces are not especially tall, sel-

C. Edward Graves Photos



dom growing more than seventy-five feet high. It is their picturesque grace of outline, due to the pendulous branchlets that give the tree its name, that impresses on the surrounding landscape an almost exotic charm. These branchlets droop from the parent branch from four to eight feet, usually in great profusion. On many trees they reach to the very ground; on others they form a framework for entrancing glimpses across mountain lakes and toward distant peaks. At the lower elevations where they are first encountered on the trails at about four thousand feet above sea level they are found in company with Douglas fir, incense cedar and yellow pine. Higher up around the lakes and on the mountain benches and in the sheltered coves they associate more closely with the red fir, western white pine and an occasional dwarf Jeffrey pine.

To rest in the shade of the drooping branches on a hot day, looking outward through the iridescent foliage across a gleaming lake, is an experience that a mountain lover will never forget. The sequoias overwhelm by their age and size; the sugar-pines delight by their perfection of beauty and form; the stunted junipers appeal to the sense of the picturesque and grotesque; but for sheer charm of rarity and uniqueness, the Weeping Spruces—the rare wild orchids of mountain trees—are unexcelled.



(Above) THE RARE WILD ORCHID of mountain trees against a background of sternly forbidding ridges

C. Edward Graves Photos



(Below) AN OCCASIONAL DWARF Jeffrey pine is found in association with the Weeping Spruce



SITTING WITH THE INDIAN JUDGES

Continued from page 274

elegant in similar costume; finally, Running-wolf, a grand old man, heroic in stature, who also looked perfectly at ease in the costume made famous by a distinguished prince and later a king.

Needless to say, I was considerably taken aback at this turn in affairs and embarrassed beyond measure at not having changed my own clothes. Who could have expected these old-timers to appear in such garb; and what was the more remarkable, to exhibit such easy habituation to this phase of white culture.

Running-wolf was quick to sense my discomfiture. He said, "We understand that you are far from home, traveling light and so not equipped for formal occasions. Therefore, you could not be expected to appear in dinner dress." But it was different with them, he explained. For since they had these clothes at hand, it was their obligation to wear them out of respect to their host.

After-dinner speech

The dinner proceeded deliberately, but without conversation, though when spoken to, a brief but respectful answer was made. But when cigars and coffee were served, Four-guns, so far the most frigid of the party, went into action. Pushing back his chair he arose, calmly surveyed the room, then said:

"I have visited the Great Father in Washington. I have attended dinners among white people. Their ways are not our ways. We eat in silence, quietly smoke a pipe, and depart. Thus is our host honored. This is not the way of the white man. After his food has been eaten, one is expected to say foolish things. Then the host feels honored. Many of the white man's ways are past our understanding, but now that we have eaten at the white man's table it is fitting that we honor our host according to the ways of his people.

"Our host has filled many notebooks with the sayings of our fathers as they came down to us. That is the way of his people; they put great store upon writing; always there is a paper. But we have learned that though there are many papers in Washington upon which are written promises to pay us for our lands, no white man seems to remember them. However, we know our host will not forget what he has written down and we hope that the white people will read it.

"But we are puzzled as to what useful end all this writing serves. Wherever white people come together there is writing. When we go to buy some sugar or tea, we see the trader busy writing in a book; even the white doctor as he sits beside his pa-

tient writes on pieces of paper. The white people must think paper has some mysterious power to help them on in the world. The Indian needs no writings, words that are true sink into his heart where they remain; he never forgets them. On the other hand, if the white man loses his papers, he is helpless. I once heard one of their preachers say that no white man was admitted to heaven unless there were writings about him in a great book.

"There are still many things we have not explained to our host. As handed down to us, the Great Spirit made the world. He made two great bodies of land, separating them by water. Then he made many kinds of plants and living creatures, different in these two great lands. However, in the course of time, he thought it best to make people to enjoy all these wonderful things. There being two separate lands, he decided to make two kinds of people—Indian and white. We know there are black people in the white man's world, but the Great Spirit had nothing to do with them; they were invented by white people as slaves to do their dirty work.

The Great Spirit's sons

"The Great Spirit first made the Indian. He said to him, 'You are the one I love the most, you are my favorite son.'

"Then the Great Spirit was wrapped in thought for a time, but finally called for the Indian to stand forth. To him and his descendants was to be given all this land of America, to enjoy to the end of time, but he and his descendants were to follow the straight road. Further, the Great Spirit spent several days instructing the Indian as to how he was to live, all of which he was expected to remember and pass on from generation to generation without change. When the Great Spirit completed these instructions, he placed the Indian in this new land.

"Then the Great Spirit remembered that there was another large body of land on the other side of the great water. To live in that land, he created the white man. When this, his second son, stood forth, he also was instructed as to how he should live in order to possess and enjoy the land, but before sending him on his way, the Great Spirit sat in silence for a long time. At last, he sorrowfully admitted that this, his second son, had such a poor memory that he feared for the outcome. So he decided to have all these instructions written down in a book. In due time the book was ready, but before handing it to his son, the Great Spirit again relapsed into silence. It was plain from his countenance that he was sad. At last he raised his eyes, his face

Continued on page 302

THE INDOOR EXPLORER

The Art of Herman Mueller, Glass-Blower

IN the Darwin Hall of the American Museum is a collection of authentically designed glass models showing what a group of microscopic animals would look like if magnified one million times or more by cubical measurement. This collection took more than thirty years to produce and cannot be duplicated anywhere in the world for the beauty and accuracy of its technique.

The glass models in these exhibition cases are the life work of a single craftsman. His name is Herman Mueller and he is one of the very few German glass-blowers of the old school now practicing the art in this country. This summer he will have completed his 35th year of Museum work. Born in Thuringia, a district famous for centuries as a glass-blowing center, Mr. Mueller was from infancy associated with the creation of beautiful objects out of glass. The forests of this mountainous country furnished wood for the slow-burning fires necessary to produce glass of the plastic type indispensable to intricate modeling. As a child, he saw this glass take on miraculous shapes in the hands of his father, grandfather, and uncles; saw his mother, brothers and sisters engaged in painting the finished ornaments—a task in which he soon joined. The Thuringian Muellers made everything from Christmas tree ornaments to laboratory flasks and beakers, but seemed to lean toward the latter commodity since by 1893 they had opened a shop of their own in New York with the bulk of the business in chemical equipment.

When Dr. B. Eric Dahlgren headed the Museum's Preparation Department back in 1903 he felt that an expert glass-blower was needed to reproduce *Paramecium*, *Vorticella*, colonies of hydroids and other tiny water forms he wished to put on display. Mr. Mueller was given the job and set right to work mastering the intricacies of this difficult assignment.

Some years later Mr. Mueller took time off from manufacturing these minuscule creatures to blow some sweet peas and four o'clocks for an

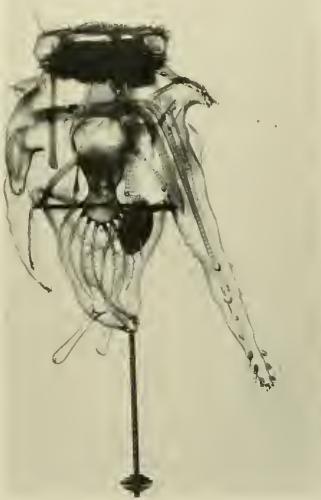
exhibit illustrating the Mendelian law of inheritance. The lifelike delicacy of this floral work is astonishing and still lends a charm to Mendel's law which it might not otherwise have for the rank and file Museum visitors. But Mr. Mueller soon returned to the more complex phases of biological interpretation. They could make pretty good flowers out of wax, but there was only one medium through which the tiny underwater life, invisible to

of 35 years, Mr. Mueller knows a great deal about their anatomy, but he does every job under the supervision of Dr. Roy Waldo Miner, Museum Curator of Living Invertebrates, to whom he is directly responsible. Mr. Mueller works from drawings made after examination of the living creature through the microscope of either Doctor Miner or Dr. Frank J. Myers, the Museum's authority on rotifers. Rotifers are among the more difficult subjects to recreate in glass. A whole colony of them could, like the angels of medieval theology, occupy a pin point if they had to. Yet Mr. Mueller makes each one anywhere from the size of a young lobster to that of a robin's egg.

"Do you," asked the writer when he dropped into Mr. Mueller's workshop, "have to acquire a certain amount of skill in the movement of your lips, like a trumpet player?"

Mr. Mueller shook his head and said that there were few points of comparison between the two arts. A glass-blower doesn't have to work so hard on his *embouchure*, but his fingerings has to be far more delicate. Mr. Mueller picked up a plain cylinder of glass about a foot long and an inch in diameter, heated one end of it over the flame of his Bunsen blow torch, then, when it was hot enough, pulled one end out so that it narrowed down to the size of an ordinary peashooter, the other end of the cylinder remaining the same. Using the peashooter end as a mouth-piece, he then heated the thick end, sealed it over, and blew. The blow was much like the quick *pfft* small boys employ to propel their missiles at the teacher. Immediately a glass bubble appeared at the hot thick end.

Of course, nearly everyone has gotten this far in the glass-blowing game, but from now on, if you are inspired to try your hand at Mr. Mueller's profession, it begins to get hard. Blowing the glass bubble is the fundamental step. From then on, you've got to work with gas flame and shaping tool in order to transform the plastic bubble into whatever

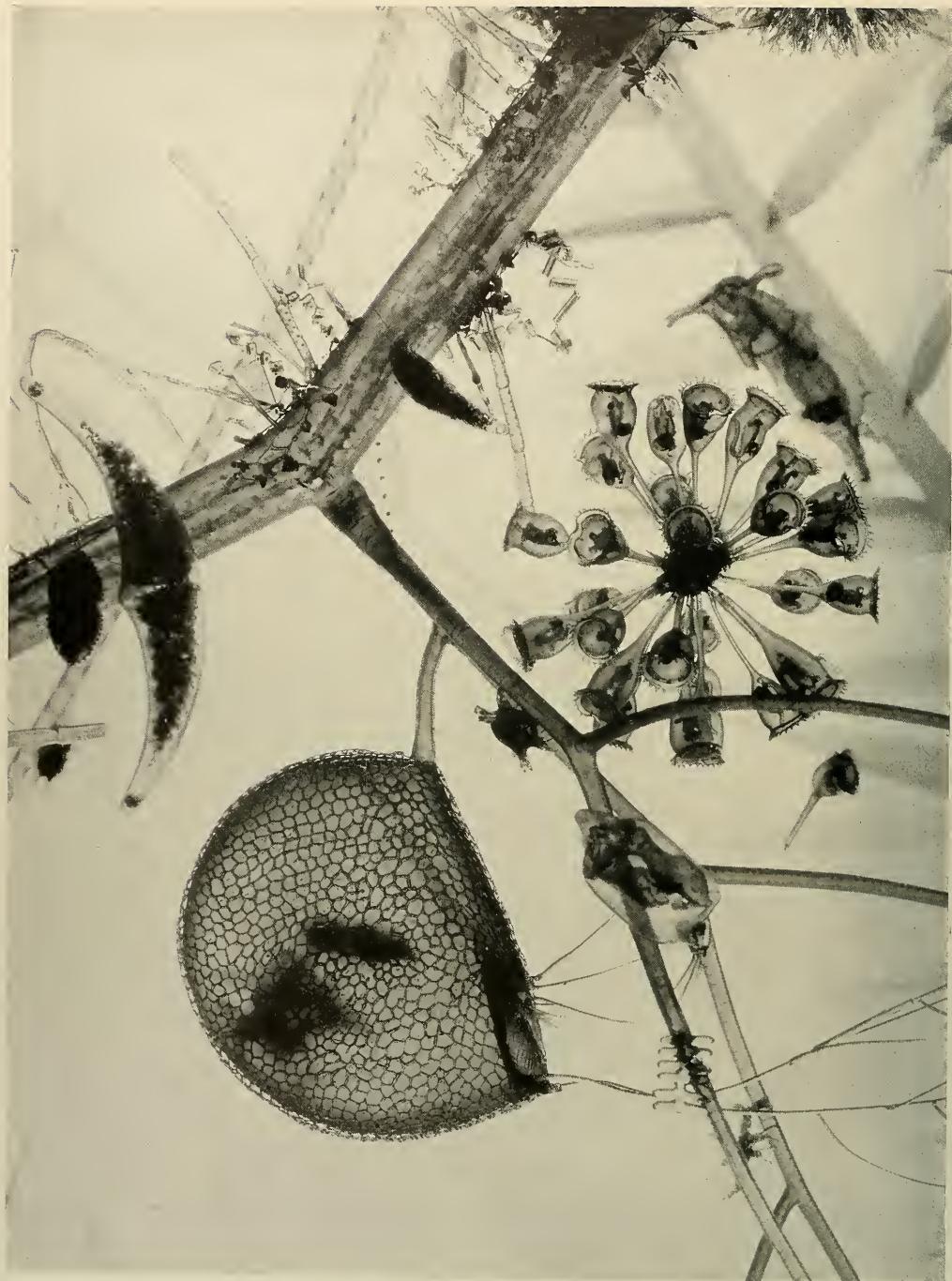


AMNH Photo

the naked eye, could be presented to the public—that was glass. So why waste a glass-blower of rare talent on sweet peas?

Mr. Mueller had picked up a smattering of zoölogy during his German schooling, had become interested in it, and didn't mind the grueling apprenticeship he had to undergo in order to make a piece of glass assume the exact shape, complete with internal organs, of an animal you could see only through the lens of a powerful microscope.

After spending his lung power in immortalizing these popularly neglected animalcules for the better part



GLASS MODELS OF MICROSCOPIC PLANTS AND ANIMALS: Magnified about one million times natural size, these models show some of the creatures living on a speck of ordinary fresh water pond bottom. At bottom center is

AMNH photo, slightly reduced from actual size of exhibited models
the utricle, carnivorous organ of the bladderwort plant, showing a rotifer inside which has slipped through the treacherous "trap door." Above right, a spherical colony of rotifers cling together by their toes

it is you are trying to duplicate. Blowing gigantic models of the tiny rotifers, like everything else, starts with the bubble. You blow the bubble to the approximate size of the main body of the rotifer. You then make the limbs, tentacles, and other appendages by pulling tubes of hot glass into the required shape and welding them on. If you want to include, as Mr. Mueller does, the internal organs (rotifers have good-sized stomachs, elementary "brains" and paired "kidneys" among other things) you're going to have quite a time of it, particularly if they are to be accurate reproductions. Mr. Mueller makes the rotifer's insides first and then, by an intricate series of weldings, gets them in their right positions inside the outer shell. Sometimes it takes him as long as two months to do this. The rotifer doesn't hide his innards the way higher forms of life do, but in his living state is quite transparent. Dissectionists may well thank Nature for thus saving them a rather ticklish piece of investigation involving feats of dexterity comparable to carving the Lord's prayer on a pin head.

In creating the rotifer groups, Mr. Mueller has reproduced the complex interplay of life forces incident to a half inch of ordinary freshwater pond bottom. The finished exhibit is scaled up about a million times natural size, measured cubically. As he viewed these models, which were conceived and planned by Doctor Miner, the writer was forced to the conclusion that the lot of the rotifer was not a happy one. For instance, it is certainly beset with more terrifying dangers than Snow White's nightmare flight through the forest. If Walt Disney ever wearies of his present animal characters he might do well to visit Herman Mueller and see what can be done about animating the life of a rotifer.

Rosie Rotifer, unless the facts of her life were carefully glossed over, might meet obstacles with the censors. Perhaps Mr. Disney would prefer to do the biography of a "he" rotifer, called, let us say, "Rollo"; but this hardly seems advisable, because the life of a male rotifer doesn't offer much material for dramatic exposition. There aren't nearly as many of them, for one thing, and they are much smaller than the females. Rotifer eggs are laid in several successive layings throughout spring and summer, at which seasons all eggs hatch out into

females. In winter comes a single brood of eggs consisting of nothing but males, whose sole function is to fertilize some of the females before they die. And they die pretty quickly since they have neither mouths to eat with nor stomachs to digest any food. That is all there is to Rollo.

Rosie, on the other hand, sets out on a life of adventure, with an assortment of little moving hairs known as cilia which she waves about in circular fashion, thus propelling herself through the water. When scientists first discovered Rosie, through the aid of the microscope, they named her "rotifer" (wheel-bearer) because of this method of swimming. The successive beating of the water by the cilia gave the optical illusion of rotation, therefore it was thought science had at last discovered an animal in which Nature had installed the principle of the wheel, the invention of which had been credited to man alone. But later investigations proved this wrong. Man is still the only form of life that has the wheel, one of the very few of his inventions not anticipated by Nature. The name "rotifer," nevertheless, stuck.

Rosie Rotifer may belong to any of a large number of species (there are 31 modeled by Mr. Mueller and shown in the exhibition cases). The chief method of species identification is by the location and nature of the jaws, which range from protruding pincers to a sort of suction pump and include about as many variations as there are species. In one form Rosie may crawl up the stem of an underwater plant by hunching herself up inch-worm-like at each "step." Her purpose in so doing is to puncture the stem of the plant at intervals and extract nourishing chlorophyl from each plant cell. In another form, she creates a rotating globe-shaped colony with a number of her sisters, each rotifer grasping the other's toes. In another, she swims with her ears—that is to say by maneuvering a set of cilia which are attached to organs resembling ear-muffs. To whatever species she may belong, her problem is always the same—a problem shared by all forms of animal life—namely, to eat and at the same time not be eaten. Like all other animals, she may fail in one or the other function. Besides chlorophyl (which she eats if she belongs to an herbivorous species), her diet may consist of other minute animals often larger in size than she is. In some forms she will brazenly pene-

trate to the gelatinous interior of a unified colony of protozoa and feed complacently on its members all her life.

Rosie has her enemies, however. Nature has provided the plant world with a champion who wreaks vengeance on the herbivorous rotifer for the amount of chlorophyl she devours. This arch-enemy is a tiny carnivorous plant called a bladderwort. The carnivorous organ of the bladderwort is the utricle, which Mr. Disney might name Uriah. Uriah Utricle attains far more sinister proportions as a villain than the cinematically over-worked spider. He is a much subtler villain. Instead of luring his prey into a web and then crudely pouncing on it, he offers to the unsuspecting rotifer a thorny collection of spines on his outer surface among which the rotifer will find plentiful game. As the rotifer picks her way through this miniature hunting park, she will eventually reach a concealed trap door, covered with slippery glandular hairs. As soon as the rotifer touches the edge of the trap door, it gives way beneath her, and the arrangement of the slippery hairs is such that all the rotifer's wrigglings will serve only to force her deeper and deeper inside the utricle. Meanwhile the trap door claps shut overhead. Even the manner in which the utricle eats its prey is tinged with the subtle fiendishness fictionally ascribed to orientals. Unlike the celebrated pitcher plant, this underwater trap does not secrete digestive juices. The rotifer simply dies for lack of food and oxygen, and as she disintegrates into fluid form, is slowly absorbed by the cell-lining of the utricle.

Mr. Mueller does not, it should be mentioned here, paint his rotifer models. This branch of the work is taken care of by Doctor Miner's staff of skilled artists who apply the precise colors that characterize the animal in life. These colors are reproduced with oil paints, sprayed on by an airbrush. There are instances, nevertheless, where Mr. Mueller must do his own coloring. These usually occur in the construction of the internal organs where the tint can best be applied by fusing variously colored glass in the flame and inclosing it within the outer parts.

Since Mr. Mueller is at or close to the top of a profession that has very few practitioners in this country, he is always in great demand. Periodically odd commercial jobs come his way. One such was a commission to

blow a set of glass ice cubes for an advertising agency. This agency had been photographing highballs for an advertisement and found that real ice cubes melted away under the intense lights of the studio. The glass cubes stood up all right in this respect but required a number of adjustments before they would float realistically. Mr. Mueller finally solved the problem by leaving a small cavity in the "ice cube" which could be filled with

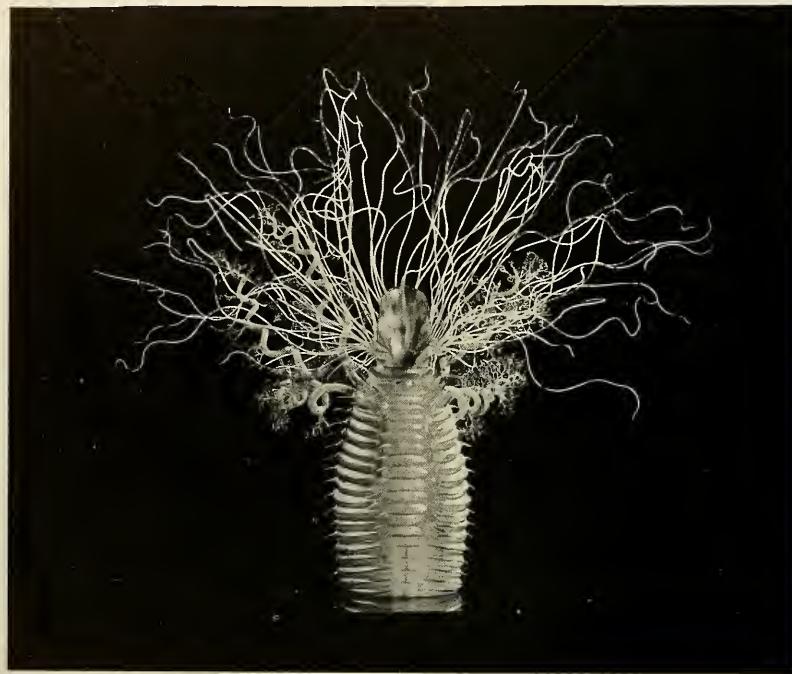
water—thus weighting the cube down to the proper level.

Modeling tiny microscopic animals and even larger water creatures like the heavily tentacled Portuguese Man-O'-War is close work, a little hard on the eyes, but immensely satisfying to his craftsman's pride. All during their long association, he and Doctor Miner have played a little game between them. Working with collecting apparatus and microscope, Doctor Miner

tries to discover some underwater organism too intricate for glass modeling; in short, he tries to stump Mr. Mueller. So far he has been quite unsuccessful.

Yet the possibilities are inexhaustible. The series of rotifers is just about finished, but in the myriad forms of invertebrate life there occurs so wide a choice of subject matter that the game will easily outlast the players.

—D. R. BARTON.



AMNH Photo

SITTING WITH THE INDIAN JUDGES

Continued from page 298

expressing shame and sorrow, because this his second son could or would not tell the truth. The Great Spirit knew his descendants would be known as liars forever and ever.

"Hence, no one would believe these white children when they claimed the Great Spirit as the giver of their book. Therefore, the Great Spirit would sign the book."

Then the speaker, looking straight at me, continued, "Naturally, the white man possessing a book in which was written the way of life and signed by the Great Spirit, had a great advantage over the Indian, eventually surpassing him and overrunning the whole earth."

The speaker lapsed into silence; I, being unable to think of anything to say, tried to assume the impassive countenance of my guests.

In due time, the venerable Running-wolf arose. His manner indicated that neither wit nor humor were in his mind. His remarks were brief, but touching. In substance, he stated that when an Indian died, he went to the land of his fathers, at least he was sure that such was his destination. Most white men went to another place, but he believed that his host was different from most white men since he was anxious to learn more and more of the Indian way. He said that last night he had a dream—a holy dream, the kind which is prophetic. In that dream he saw

himself in the heaven of his fathers. Then he saw the writer walking up the trail with notebook and pencil. He believed that his own days were numbered, but that after a time he should meet again with his host. He hoped that it might be so.

After a pipe around, we shook hands and wished each other well. It was the last time I ever saw these three venerable judges, so sedate in their ultra civilized clothing yet so redolent of the philosophy of their fathers. Their bones now lie on the hills of their country; may they rest in peace.

If anything were to be inscribed on a stone or tablet to these Indian judges it should read: "Of all men, masters in common sense."

SCIENCE IN THE FIELD AND IN THE LABORATORY— *Conservation at Home and Abroad—Annual Bird Walks—Two African Expeditions—The Porpoise and the Mercy Bullet—A Fossil Gaur Skeleton*

Conservation News

Last month's proclamation of National Wild-Life Restoration Week from March 20th to 26th followed closely on the heels of the 3rd Annual Conference of North American Wild-life held in Baltimore during February and demonstrated a hearteningly widespread public interest in conservation. Among the results of the Wild-life Society meeting was the passage of a resolution calling upon authorities concerned to investigate and put into effect methods to control the wilt (*Cephalosporium* sp.) which seemingly threatens the existence of the native American persimmon, an important wild-life food in the southeastern United States.

More recently, the American Museum expressed its concern for the wild-life of another continent in the following cablegram to the Minister of Lands in Pretoria, Transvaal, Africa: "The American Museum of Natural History always ready to endorse constructive proposals for conservation of threatened species whenever they exist commands the Union Government of South Africa for its attempts to give sanctuary to such of its fauna as is facing extinction and hopes that this same wise policy will extend to the creation of a natural reserve in Natal to give permanent protection to the red hartebeest."

(Signed) F. TRUKEE DAVISON."

Snyder East African Expedition

Planning to make their way along a route which has never been traveled since Stanley went to Livingston's rescue in 1879, the Snyder East African Expedition left for the field early in March. Made possible through the generosity of Harry Snyder who will act as leader, the expedition hopes to secure still and motion pictures of rhino, elephant, buffalo, lion and other big game animals, in addition to making representative collections around Kinshasa. In order to cope with the considerable number of waterways that lie in the Expedition's path, a 22-horsepower outboard motor attached to a steel canoe has been added to the usual land-going equipment.

With Mr. Snyder on the expedition are Colonel A. J. Macnab, Mr. George C. Goodwin, Assistant Curator of Mammals in the American Museum, and Mr. J. A. Hunter, a veteran hunter, from Nairobi.

Amateur Astronomers Meetings

The meetings of the Amateur Astronomers Association at 8:15 p.m., on Wednesdays in the Roosevelt Memorial Building, and of the Junior Astronomy Club

on Saturdays at 8:00 p.m. in the same place, continue as follows:

Amateur Astronomers Association

April 6th—"Ancient Astronomical Instruments," Dr. George Rosengarten, Philadelphia College of Pharmacy and Science.

April 20th—"Spinning Bodies" (with demonstrations), Dr. Richard M. Sutton, Haverford College.

Junior Astronomy Club

April 9th—Dr. H. H. Sheldon, "The Size and Distances of the Stars," New York University.

April 23rd—Speaker chosen by competition, Annual Jubilee.

Bird Walks in Central Park

During the migratory season Central Park is a haven for birds on their long



flight north, and in April and May many rare species can be studied at close range. Among recent uncommon visitors have been the clapper rail, killdeer, Acadian flycatcher, blue-gray gnatcatcher, Philadelphia vireo, and summer tanager. Every year many more familiar bird friends frequent the ramble—ruby-crowned kinglets, yellow-breasted chats, rusty black-birds, indigo buntings, and an abundance of warblers.

On Tuesday, April 19th, Mrs. Gladys Gordon Fry, known to bird lovers and students as "The Bird Lady," will open her seventh series of bird and tree walks in Central Park, under the auspices of the American Museum of Natural History. This is one of the delightful spring adult education activities offered by the Museum, and alertness credit will be allowed teachers passing an examination upon completion of the course.

The early morning group will meet at six-thirty o'clock on Tuesdays and Fridays, beginning April 19th. There will also be a nine-thirty o'clock group on these days. Each class period will be one

and one-half hours in length. The fee for the course of ten lessons will be \$12.00.

Five all-day Saturday field trips to noted bird habitats in the suburbs will be conducted on April 23, 30, May 7, 14, and 21. These will include the Jones Beach Bird Sanctuary on Long Island, Westmoreland Farm, Bedford Hills, N. Y., Troy Meadows, N. J., Franklin Lake, N. J., and Hatfield Swamp, N. J. This course will be supplemented by study of Museum specimens. The fee for the course of five field trips will be \$20.00.

The rendezvous for all groups will be at the main entrance, Roosevelt Memorial, 79th Street and Central Park West. Applications may be made to the Department of Education, Room 306, School Service Building, American Museum of Natural History, or by telephoning ENDICOTT 2-8500, Extension 248.

Fees may be paid at the time of registration. Checks should be made out to the American Museum of Natural History and mailed to Dr. Charles Russell, Curator of the Department of Education at the Museum.

Captive Porpoise

The only porpoise now alive in captivity was recently captured with the aid of a "mercy bullet" (a small narcotized projectile) and placed in the world's largest aquarium at Marine Studios, Marineland, near St. Augustine, Florida. Here under the direction of W. Douglas Burden, trustee of the American Museum, two large tanks known as "Oceans in Miniature" will present to the public a collection of aquatic mammals and fish in their natural surroundings, under conditions duplicated nowhere else in the world. On arrival at Marineland, this harbor porpoise weighing about 100 pounds, was carried on a stretcher to the rim of one of the tanks. Immediately on being lowered into the water, the porpoise went to the bottom and, recovering from the effects of the mercy bullet began to swim about actively in his new home—as complete a natural habitat as can artificially be constructed.*

Discussing this unusual capture, Dr. G. Kingsley Noble, Curator of Experimental Biology in the American Museum, who was conducting researches at Marineland, remarked that the capturing of wild animals alive has been aided through using the mercy bullet. Thus we began experimenting with drugs on fish to determine whether they could not be captured in a somewhat similar manner. Our experiments with about seventeen drugs showed that drugs which were most toxic to man were in general less toxic to fish. We finally determined that one

* For more complete details see NATURAL HISTORY science notes for January, 1938.

particular drug could be concentrated sufficiently to be effective yet not harmful to the fish."

The amount of drug necessary in a given case depends on the size and physical condition of each species. This was determined by Mr. Ilia A. Tolstoy, grandson of the famous Russian novelist, Count Tolstoy, who founded the Little Brother movement. Mr. Tolstoy is now using this mercy drug in his efforts to capture alive large fish such as sharks, porpoises, rays, and other types which are being placed in the Marine Studio's aquariums for scientific study.

Fossil Gaur Skeleton

There has just been mounted by Mr. Charles Lang in the Department of vertebrate Palaeontology, a complete skeleton of an early Pleistocene Gaur obtained by the Central Asiatic Expedition in eastern Szechwan Province, China.

The gaurs are the largest of the ox family and are found living today in several parts of tropical southeastern Asia. This fossil gaur is larger than even the largest of its living relatives and therefore stands as the king of the bovids. It was one of the specimens obtained from the Chinese, who excavate these fossil bones and sell them as medicine; "dragon bones" have for generations been considered as possessing medicinal value. This new skeleton will be placed on exhibition shortly.

Vernay-Kaffrarian African Expedition

T. Donald Carter, Museum representative on the Vernay-Kaffrarian African Expedition, landed at King William's Town from which point he embarked on a tour of various African Museums including that at Capetown. His examination of the mammal collections contained

in these Museums will enable him to anticipate and familiarize himself with many of the specimens he plans subsequently to collect in Northern Rhodesia and the Upper Zambesi.

The American Museum's Assistant Curator of Mammals reports that he and Captain Guy S. Shortridge, leader of the Expedition, will be unable to make their way into the collecting grounds until May, due to the heavy rainy season. In the meantime it is planned to attend a Congress of Museums in Durbin. Negotiations are now being conducted whereby the Kaffrarian Museum of which Captain Shortridge is Director will share some of its rare specimens with this Museum's mammal department. Mr. Carter reported that working on the Kaffrarian study collection was a great experience for him and that he has found at least one specimen of a genus different from anything he has previously encountered in these parts.

LETTERS

Sirs:

I wonder if you and your readers realize the unique gift our country possesses in the "genius of Charles Knight" [February, 1938, NATURAL HISTORY]. No one living can draw animal life as he does. He has wrought line and life together. The force of his drawings comes from the knowledge he possesses of animal life. Barye alone could value his drawings as they should be valued; we are not possessed with the experience necessary, but we do know they are beyond criticism.

GEORGE GREY BARNARD.

Sirs:

Permit me a few words of commendation for your calendar "Who—When—Where." It makes one realize the tremendous advantages of living in this city, advantages which New York residents frequently mention without truly understanding or generally grasping them.

New York City. EUGENE EISENMAN.

* * *

Members of the American Museum of Natural History who may have read Dr. Harry L. Shapiro's "Pitcairniana" in the January issue, or his book, *The Heritage of the Bounty*, may find interest in the following letters written by Mrs. William J. Tobey, who many years ago visited remote Pitcairn twice as the daughter of the captain of a clipper ship. Mrs. Tobey is distantly related to Professor Albert Smith Bickmore who originated the conception of the American Museum of Natural History in 1868.—ED.

My dear Dr. Shapiro:

No small boy reading *Treasure Island* for the first time was ever more thrilled that I with *The Heritage of the Bounty*, for two reasons, first because it is de-

lightfully written and secondly because I have visited Pitcairn Island twice, before you were born, but too late for the redoubtable Mr. Hill to "give an arm" up that steep and slippery path where I was pushed, pulled and almost carried amid much laughter.

My father was captain of a clipper ship, built in this town, and after I finished school I made two voyages with him round the Horn.

On each homeward passage we spent a day at Pitcairn and met Simon Young, Rosalind and Eunice Jane Lawrence Young, Thursday October Christian and many others.

Russell McCoy was the Governor. He afterward went to England with Capt. Warren Mills of the ship *Harvey Mills*, another Thomaston ship. It was Capt. Mills who took the organ to them, and I can tell you almost to a man the names of the folk who contributed money for its purchase. Queen Victoria also sent them an organ; there was one in the church and one in the schoolhouse.

For years afterward Rosalind Young and I corresponded, but her letters, alas have "gone with the wind." I still have a bag she wove for me, a sea urchin, once covered with purple "slate pencils" and a gourd with quite an intricate pattern traced on it.

The tapa samples and the leis made of crimson immortelles have disappeared, but I still have a coconut from which the milk was drained, the holes plugged, then polished.

When we were there the population was as follows: 13 adult males, 19 adult females and 59 boys and girls, among them a pair of darling little twins, Rose and Lily. I don't remember their family name but you probably have it.

The picture of the Christian house took me back to the day when the shutters of one of the windows were slid back and I leaned out and dripped pineapple juice all over the grass.

They wanted us to eat something in every house we visited, and could not do enough to make us feel at home.

On being introduced to one of the young girls my father said "Bless my soul, my dear, I am glad to meet you." Whereupon her mother in a shocked tone said, "Captain, that is very strong language."

A year or two later Rosalind wrote me that someone had named a baby for me (Caroline or Carrie Jordan). Have you any record of her? To whom did Rose and Lily belong?

A year or more ago Lincoln Colcord started the Maine Marine Museum at Searsport and I was told by someone professing to know that the rudder of the *Bounty* had been purchased by a New York man and was to be given by him to the Museum, but I can hardly credit this yarn. Do you think it is so?

Who is the pretty girl beside Burley? It was Mrs. Warren who was so horrified at my father.

The first thing they asked for when they came aboard the ship was the last Moody and Sankey hymn book and *perfumery*, both of which we were able to furnish and (I quote from a letter to my grandmother, which has survived), "I gave them my linen suit, my brown silk dress, the one with the overskirt and lots of other things."

I even wrote "a paper," which was read at a Sunday School concert in Portland. What wouldn't I give to see it now.

You also mention the ship *Edward O'Brien*; she too was built in Thomaston, but before I was born.

It seems to me everybody sang, the men and boys having really beautiful voices. When they brought us back to the ship we gave them a scene or two from *Pinafore* but I think they preferred Moody and Sankey, though they liked the piano and wondered how I could make my fingers "fly so fast."

On the Magic Key hour last Sunday
Continued on page 314

NATURAL HISTORY, APRIL, 1938

YOUR NEW BOOKS

ANIMAL TREASURE: A DISSENT • WISSLER'S AMERICAN INDIAN • A BIOLOGIST
LOOKS AT PHILOSOPHY • PEATTIE'S PRAIRIE GROVE
NATURE PHOTOGRAPHY • ON EARLY MAN

THE AMERICAN INDIAN

— by Clark Wissler
Oxford University Press, Third Edition, \$3.75

SINCE the publication of the first edition in 1917, *The American Indian* by Clark Wissler has been an item of standard equipment for every serious student of New World anthropology. As a well organized and not too formidable introduction to a rich and complex field it has served scientific neophytes and interested laymen equally well. The appearance this year of a third and considerably revised edition is therefore a noteworthy event for scientist and general reader alike.

The importance of this concise and authoritative book to the beginner in any field of American ethnology, linguistics, archaeology, or physical anthropology cannot be overestimated. The outgrowth of an exceptionally rich museum and field experience, it presents in classified and descriptive form the highly variable patterns of Indian life in North, Central, and South America. In a field marked by the exuberant production of monographs on special subjects this book alone has been, and remains, the one organized work covering the entire field.

Viewed as a whole, one gains the impression that, whereas New World archaeology has developed rapidly of late, ethnological and physical anthropological viewpoints have remained more constant. As regards ethnology this impression is, in part, due to lack of emphasis on certain recent psychological trends perhaps hardly germane to this type of handbook.

Meanwhile, the present work in its revised form remains preeminent in its field. This field, as summed up by Doctor Wissler, concerns "an isolated people who did not travel the road to higher cultures as rapidly as their relatives in Asia, the connection between whose centers of development has long been broken by climatic changes and later almost completely blocked by hordes of primitive hunter and fisher folk. We can only speculate as to what a few more thousand years of this freedom would have done for the New World, for in the sixteenth century a calamity, which has no exact parallel in history, befell the New World. A militant foreign civilization, fired by a zeal not only to plunder the material treasures of mankind, but to seize the very souls of men in the name of its God, fell upon the two great centers of aboriginal culture

like a thunder bolt from a clear sky. The blow was mortal. But the man of the New World went down fighting. Though his feeble survivors still continue the struggle in a few distant outposts, the first great onslaught that annihilated the Aztec and the Inca marks the end of our story. In this volume we have been concerned only with the history of a race and a culture of which the aboriginal city-states of Mexico and Peru were the culmination. As we look back upon the long and tortuous career of man in the New World, comprehend his crude equipment as he first set foot upon the land, and pass in review his later achievements, we cannot but regret that the end came so suddenly."

WM. DUNCAN STRONG.



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- builds dams with his feet and not with his tail?

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100 FIFTH AVENUE, NEW YORK

ANIMAL TREASURE

— by Ivan T. Sanderson
The Viking Press, \$3.50

ANIMAL TREASURE has created quite a furor. It has been hailed as a contribution to literature and to science, and Sanderson, the author, has been compared to William Henry Hudson. For a time this book has appeared on the list of non-fiction best sellers. It might have been placed on the fiction list with equal propriety for it certainly does not have the ring of truth that one usually associates with a bona fide account of biological field work. To a naturalist who has the experience to make a competent comparison between Sanderson and Hudson, the very idea itself seems absurd.

Unfortunately, the lay reader cannot be expected to have the background qualifying him to weigh the great mass of facts and what pass as facts in *Animal Treasure*. He assumes that events took place just as described, that categorical statements are facts beyond question, and that the measure of success claimed by the author is conceded him by the workers in those particular fields. But if all this is true, how colorless, how unimportant and how futile have been the expeditions of the past. What hope is there for the expeditions of the future if their leaders do not don the rosy hued spectacles of a Sanderson. Herein lies the greatest menace of a book such as *Animal Treasure*, the subordinating of well-considered, factual narratives woven about museum expeditions.

Sanderson decries the mode of expedition collectors who preceded him. He believes they have gone about things in a misguided fashion and he intends to change all this. Taken at his own word, we must grant he has been successful. The pages of the book echo and reecho to the letting off of both barrels of the shotgun, which seems to be used with a fine disregard for animal and human rights. Most collectors have too much regard for wild life to use every hawk as an excuse to target a shotgun, as Sanderson and his party do. Climbing about tree tops with the safety off the shotgun, shooting at bats flying about inside a house with the resultant hole blown through the roof, firing at bats emerging from an opening where the head of a native may appear at any moment, all such episodes suggest heedless, careless boys rather than experienced collectors. In such respects the

Sanderson expedition undoubtedly broke out of the rut of ordinary expeditions, but also this adds spice and variety to the narrative and not until the last page is reached can the reader be certain that someone has not stopped a charge of shot.

Sanderson was working in a region which possesses a very rich fauna. This part of West Africa is the home of many rare and exceedingly interesting animals. The collectors meet with an impressive list of the rarities, and on this score they deserve great credit. Some of the species are not as rare as Sanderson thinks they are, but the securing of additional specimens can still be counted as a feather in the cap of the man who collects them.

The style of the book is graphic and moving and there are few dull moments. The descriptive passages take the reader right into the heart of things. Sometimes the deductions of the author appear to have rather tenuous foundations, and the reader is entitled to wonder if Sanderson has guessed correctly.

The selection of the title would appear to be a happy one, if the connotation of the word "treasure" is taken into account. The dictionary does not give a definition to support the suggestion which comes to mind when one hears of "hidden treasure" or "pirate treasure" but there is the idea involved, in such instances, that perhaps there is no such thing in existence. In other words, to believe in "hidden treasure" requires faith and imagination. Just so, if the reader believes that "treasure" lies within the covers of Sanderson's book, his faith will make its discovery easy. It is too bad that some of this treasure, for all its glitter, turns out to be "fool's gold."

Lack of space prohibits citing in detail some of the statements made by Sanderson which do not stand up well upon analysis. These have been brought out in other reviews, the most telling of which appeared in the *Scientific Monthly* for January, 1938. If the present review seems unduly severe, it should be pointed out that only a museum or kindred institution has the data to review a book such as Sanderson's, and a discussion from such a source must expect to be taken seriously. The publicity given the book makes it necessary to face the issue squarely. If Sanderson is right, the museums are wrong. It may be that the appearance of *Animal Treasure* will mark an epoch in field biology, and expeditions will be dated B. S. or A. S., before or after Sanderson, but this reviewer believes that most field men will still prefer to follow the old methods even if they do not produce best sellers.

H. E. ANTHONY.

THE HUMAN VALUE OF BIOLOGY

— — — — — by Johan Hjort

Harvard University Press, \$2.50

DR. JOHAN HJORT, the distinguished Norwegian biologist, has long been one of the foremost students of marine biology, especially in its practical application to the fish and whale industries. He was selected as one of the few biologists to take a leading part in the Harvard

Tercentenary ceremonies. While visiting Cambridge he revised in the form of the present book, the series of lectures which he had presented before the younger students at the biological laboratory at the University of Oslo. The title of these collected lectures is ambiguous and should read "A Biologist's Philosophical Outlook on Life." It is Doctor Hjort's thesis that biology should be interpreted by biologists and not by philosophies derived from physics and mathematics. Hence a considerable part of these collected lectures deals with the interpretation of biology in the light of classical philosophies.

Perhaps the most stimulating part of the book deals with the biological discoveries which Doctor Hjort and his associates have made. It is impressive to learn that tens of thousands of fishermen working in a limited area have not been able to affect the fluctuation of the fish population while a slight change in climate has been able to produce an enormous reduction in numbers, merely by modifying the food of the younger stages of the fish. There are principles in the rise and fall of populations which apply to both fish and man, and it is Doctor Hjort's thesis that rational sociology including both politics and government should take cognizance of these principles. He illustrates this thesis by presenting a story of the rise of the prawn industry in Norway which was made possible by the biological discoveries he made.

Doctor Hjort summarizes his views with a statement that those who would serve society best should direct their efforts toward "liberating those who suffer from want of intellectual activity in their work, the greatest of all social diseases."

G. K. N.

THE STORY OF 20TH CENTURY EXPLORATION

— — — — — by Charles E. Key, F. R. G. S.

Alfred A. Knopf, \$3.50

THIS composite narrative of the conquest of the last great geographical mysteries is an informative and absorbing book written by a man who has specialized in history and geography in Cambridge University. He has drawn not only from the voluminous published records of expeditions but from privately printed documents and letters, but he does not burden the book with details which do not either enhance the dramatic effect or illustrate typical problems encountered in the various regions discussed.

Probably no equal period in history can show such extensive exploratory achievements as those of the recent decades chosen by this author, and his book well shows the strides that have been made lately in the methods of exploration.

As the story unfolds we see the airplane, the motor car, and the radio taking their place, and the nature of the objectives likewise undergoes a change. But the author devotes more attention to the sealing of unclimbed peaks and the charting of unmapped territory than to discoveries of buried cities, primitive tribes or dinosaur graveyards. If more emphasis seems to be laid on the more dramatic, mobile expeditions with objectives chiefly geo-

graphical than on the intensive scientific aspects of many present-day expeditions, let it be remembered that exploration has only recently emerged from the "flag-planting" era and that without the strong spirit of adventure that accompanies the pioneer work, the scientific achievements that follow would not be possible.

E. M. W.

EARLY MAN

Edited by George Grant MacCurdy

J. B. Lippincott Company, \$5.00

THIS unique volume is made up of thirty-six brief, clear-cut essays dealing with practically all aspects of the origin, the antiquity, and the development of early man and of his culture. Originally of greater length, these are papers read, in large part by leading world authorities, at the International Symposium held to celebrate the 125th anniversary of the Academy of Natural Sciences of Philadelphia in March of last year. Geographically speaking, the entire world is dealt with in one way or another, but the emphasis is naturally on the American continent and its long-standing unsolved archaeological problems.

No one man could write an adequate review of all these more or less technical expositions; but, on the other hand, were the widely divergent topics parcelled out to specialists the results would exceed the space here available. It must suffice therefore to state that of the round three dozen papers three are devoted to Europe, seven to Asia, one to Africa, three to Indonesia (Java), one to the Pacific Islands, one to South America, and sixteen to the United States. These localizable presentations, together with three purely topical papers, cover almost every imaginable type of material evidence having bearing on "early man" as presented by experts in geology, climatology, botany, vertebrate and invertebrate zoology, paleontology, human osteology, and material culture. Dealt with, for example, are such refined subjects as geochronology, Pleistocene stratigraphy, pollen analysis, Post-glacial forests, marine and fresh water mollusca, Pleistocene and Post-glacial mammals, transpacific migration, and, naturally enough, all the newly found evidence bearing on the antiquity of man in America.

This latter problem is viewed from many different angles, cultural and environmental, and is brought to a fairly clear, though divided, focus. On the one hand, the external evidence, particularly the Old World environmental conditions favoring migration to the New World, is by some authors regarded as pointing to a very late Post-glacial arrival, dated by Dr. H. J. Spinden at about 2500 B.C. On the other hand, the internal evidence—the various recent archaeological discoveries in both North and South America—are by others held to point even more definitely to an early Post-glacial date, which some would carry back all of fifteen or twenty thousand years. To the disinterested student a compromise seems inevitable. The truth more than likely lies somewhere between the two extremes.

N. C. NELSON.

NATURE PHOTOGRAPHY AROUND THE YEAR

----- By Percy A. Morris
D. Appleton-Century Company, \$4.00

MR. MORRIS has provided us with a book that is much more than a treatise on nature photography—rather he has prepared an almanac for the amateur (and professional) naturalist who lives in the northeastern section of our country. It is written in a distinctive and original style, is replete with personal observation, and contains some two hundred photographs which not only illustrate the topics discussed, but also serve to emphasize the author's qualifications for a work of this kind.

The introductory chapter deals with the equipment essential for effective nature photography, and includes a discussion of the comparative advantages of the various types of cameras, lenses, filters, films and other accessories. The succeeding twelve chapters are devoted to a review of the variety of subjects which may be hunted with the camera during each month of the year. March is the first month discussed; it being the opening of spring and the beginning of the naturalists' year. Some of the multitudinous forms of the life of field, orchard, forest, swamp, back-yard, seashore, tide pool and fresh water pond and stream are noted, each with some relatively distinctive feature to aid in fairly accurate determination. Suggestive notes as to method and treatment in photography are abundant, but do not interrupt the trend of the true subject matter. The many illustrations are fully documented with data on light conditions, exposure, shutter opening, filter, etc.

This is a book by an amateur naturalist which merits the attention of all naturalists. It is delightful reading.

H. E. VOKES.

HOW TO KNOW PEOPLE BY THEIR HANDS

----- by Josef Ranald
Modern Age Books, Inc., 95c.

HERALDED as a scientific treatment of hand analysis written by an Austrian who holds a Ph.D. from the University of Vienna and is a student in the Sigmund Freud School of Applied Psycho-Analysis, this book is an anomaly. Intuition rather than statistical proof seems to be Dr. Ranald's method of treating the 50,000 hand-impressions repeated to comprise his collection which includes those of some of the world's most famous people.

Dr. Ranald departs from the fortune teller's method (which he scorns) only in the section entitled "The Doctor Looks at Hands" in which he refers to some medical interpretations of the condition of the hand, and in which he is treading on more plausible scientific ground. But all in all, the book is entertaining. It makes good rainy day fun for the family or parlor amusement for your guests.

J. B.

**AUDUBON THE
NATURALIST**
----- by Francis Hobart Herrick
D. Appleton-Century Company
Second Edition, \$6.00

FIRST published in 1917, in two volumes, Professor Herrick's standard biography of Audubon now appears in a single volume of about 1000 pages. Beyond a "Foreword and Postscript" of 36 pages, effectually disposing of the Dauphin myth, the text is that of the original edition. For twenty years it has served as an authoritative source book for popular writers on Audubon. Let us hope that it may now reap the crop for which it supplied the seed.

To write adequately of the romance of Audubon's life, of the charm of his personality, of the period in which he lived, of the explorations he made, of his achievements as a student and painter of birds and of his amazing success in making his work known, calls for more than the gifts of the poet or story-teller.

Professor Herrick's bibliography contains 267 titles. Properly to digest all this material, to solve the riddle of Audubon's birth, to estimate his true place as naturalist, artist, author and publisher calls for exceptional qualifications as a biographer. On all but one count Professor Herrick seems prepared to speak with authority. Trained in methods of research and to value accuracy, a bibliographer in practice, an ornithologist by profession, a student of Audubon's life for the love of it, he needs only to be an artist to become the ideal biographer of his subject.

Some day, let us hope, a trained artist, who is also a born bird painter, will write understandingly of Audubon's work in painting birds. Meanwhile, we are safe with Professor Herrick.

F. M. C.

DANGER IS MY BUSINESS

----- by John D. Craig
Simon and Schuster, \$3.00

A TWENTY-YEAR-OLD clerk in a California tool factory suddenly found himself rich when oil was discovered on his property. At once he set out to see the world and to seek adventure. This young man was John Craig. Immediately he was possessed with the desire of photographing the strange and unusual on earth so people "at home" could see and enjoy the things they were never able to experience. This he has done in some thirty-five countries, and audiences everywhere have been thrilled by his sequences used in such pictures as *Trader Horn*, and *Devil Tiger*. Captain John D. Craig is now thirty-four and in *Danger Is My Business* he tells the story of his life—a life crammed brimful of adventure. He has climbed the Pyramids; he has been held prisoner by the Riffs; he has gone after tigers with gun and with camera in the jungles of India; and for the past eight years, with a crew of adventurous young men, he has engaged in one of the most dangerous of all businesses—deep-sea diving. In his time he has roamed the floors

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**A History of His Life
and Time**
By Francis
Hobart Herrick

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Introduction by
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of many seas and has experienced practically every possible danger in that relatively unknown world. And in all these dare-devilish adventures, each time he was in a tight spot, the human Craig would repeat the bracing formula of the courageous man in the story his father had told him—"So far I am all right."

Captain Craig is a showman, and he puts on a grand show. Every page of his book is a thriller, yet it is obvious that he is but modestly relating what has actually happened. His descriptions are clear and vivid; and his characters are brought in almost unnoticed and they at once become part of the story. Of course he is a Hollywood photographer and frequently his style becomes almost saturated with the jargon of the cinema. That, however, is no particular sin, and often it is a relief. Likewise, it might be said that there are a few inaccuracies. For instance, on page 233 he says, "There are no polar bears in Alaska." What he means is, there are none in southern Alaska for on the same page he says, "We'd have to go into the Arctic." Then too, the *Lusitania* is not in the Irish Sea, but it is awfully close to it.

It is true that Captain Craig recognizes his danger business as a show, but one cannot help realizing that he also regards it from a serious view point. He is constantly striving to improve diving equipment and does it scientifically. Along this line, he has accomplished much. Through his efforts, underwater radio broadcasting has been made possible. That in itself is a marked achievement. He may not have been the first to use helium to shorten the time of decompressing a diver, but the result of experimentation by himself and associates was to reduce the time to one-twenty-fourth below previous safety. And the Craig-Nohl diving suit is the most up to date of its kind. Most of this he has accomplished in preparation for the most dangerous of all his undertakings—filming the salvage work on the *Lusitania*.

ERICH M. SCHLAIKJER.

EXPLORING AS A CAREER

The Institute for Research, Chicago, \$1.00

THE purpose of this brochure is to give useful information to the prospective explorer. Against a historical background it analyzes the special academic and practical training that will prove valuable to anyone who seeks a career in the less civilized parts of the world, either in the interests of science or commerce. The brochure was prepared by a group of well-known educators and scholars.

E. M. W.

AUSTRALIA'S ENTAIL

----- by A. O. Barrett
Robertson and Mullen, Ltd.,
Melbourne, 6 s.

HERE is a book from Australia dedicated to the man in the street, everywhere about this broad world. It is a most interesting book. As stated in the pronouncement, it represents the result of a lifetime spent by an amateur in observation, experiment and study of plants as a hobby and their effect upon human lives.

The book is divided into two parts. The first part deals with soil, the salient features of plant life, how plants live, and how our interest and respect for them grows with our increased knowledge of the peculiarities and habits of plants. The second part deals with the priceless entail of Australia—the natural indigenous plants and their relation to the present and future economic life of the country.

This book is not a text book, instead it is a most interesting and illuminating account of Mr. Barrett's observations and experiments on plants of various kinds under the varied climatic conditions which exist in Australia. It contains instructive and useful information for those who grow or cultivate plants or crops in wet or arid regions. It contains data about plants that are particularly applicable to the Great Plains area of the United States and other regions where marginal or submarginal lands exist. Among other things it tells what the food of plants consists of, how some of it is derived from the soil by the roots and other essential parts from the air by the leaves. It tells how a plant lives and what causes it to die. For instance, one of the essential features of growth is that the roots must be kept in absolute darkness. Salts of various kinds are taken from the soil by the roots and carried up to the leaves, sugars in turn are sent down to the roots for the building of root cells.

Plants suitable for holding soils, sands or silts that are apt to be blown by the wind are also discussed. Dust storms in Australia are as violent and as formidable as those in the "Dust Bowl" of the U.S.A. The preservation of Australia's entail is as serious a problem as that of the United States. Read this book and be informed of Nature's great plant and soil heritages.

CHESTER A. REEDS.

MILESTONES IN MEDICINE

—Laiy Lectures of the New York Academy of Medicine

D. Appleton-Century Company, \$2.00

OF the series of laity lectures at the Academy, those of the 1936-1937 season are published in this little volume. They are:

The Historical Background of Psychiatry by Smith Ely Jelliffe, M. D.; The Mechanisms of Heredity, by Charles R. Stockard, M. D.; Medicine at Sea in the Days of Sail, by Karl Vogel, M. D.; The Evolution of the Human Brain, by Frederick Tilney, M. D.; The History of Medical History, by Henry E. Sigerist, M. D.; The History of Leprosy, by Newton E. Wayson, M. D.; The Story of the Glands of Internal Secretion, by Walter Timme, M. D.

The presentation of such interesting topics in science by such technically unassailable authorities, may be safely left to the reader's appreciation without doubt of his being delighted. But it is the Academy's decision (implicit in these writings) to become educators (and therefore leaders) with which this reviewer is particularly concerned. Let us, then, consider this important decision of physicians to edu-

cate, to lead; for the implications of truly leading and of leading honestly might well make academicians fear to tread.

We need language for the specialist and the general public which shall be mutually comprehensive and comprehensible, definite and definitive. It is far more important for speculative thought to tell what it is talking about than for it to be right the first time. Most education (and leadership) is nonsense because it has not yet made a standard definition of its terms, or evolved a general theory of value. If mathematicians, for instance, need a concept of probable number, their interests and interpretations in order to be useful should be apparent in outline to the public health man, the psychiatrist, the surgeon and his patient. Evolution, however delightful for purposes of abstract discussion, is much over-emphasized. It is only a modest history of the mutation of *some* species, not an indication of what species or organization of species we might aspire toward. It is of no more cosmic importance than the *history of some* light; no more helpful that the history of Hannibal. Is humanity but a few individualistic tinkles among gigantic harmonies? Is there any part that we can at least try for? Experience, experiment, more comprehensive and definitive thought . . . To lead, to educate, to be honest. Thus academicians tread.

RANDOLPH BARTON, M. D.

GARDENING INDOORS

----- by F. F. Rockwell
and Esther C. Grayson

Macmillan, \$2.50

IN this day of specialization it seems quite fitting that even the growing of the favorite house plant should become a scientific and highly specialized form of Art, where color, size, and shape is considered in relation to the place the plant is to occupy in the house.

For many plants the correct soil composition, the proper amount of light, the shape and rapidity of growth in relation to available space, the color of flower and leaf in relation to the color scheme of the room and innumerable other problems have been determined. The results of experimentation are now made available in capsule form, so to speak, in *Gardening Indoors* by the well known F. F. Rockwell and his co-author Esther C. Grayson.

If you are one who enjoys following directions you will not have to face the problems which confront the now outmoded indoor plant raiser of the heterogeneous mixture of, shall we say, Lady Washington geraniums, begonias, coleus and amaryllis. It is doubtful whether many of these old-fashioned growers gave much thought to the color scheme created by their groups of blooming flowers, or wondered whether the vine would trail in a graceful curve. Then, too, it may have taken much experimenting to find that the slip from grandmother's *Gloxinia* did not like to have its face washed any more than the Seven Little Dwarfs, in *Snow White*.

They undoubtedly would have been grateful for statements such as these;

the *Gloxinia* and African violet must absorb their moisture from below, do not sprinkle; primulas do best in cool temperatures; do not let drops of water stand on the delicate leaves of the *Saxifrage* *sarentosa*; the fibrous-rooted begonias must never have "wet-feet" or wet foliage; during the blooming period Lady Washington geraniums need fresh air and full sun.

It is interesting to note that the branches of the Norfolk Island Pine must not touch the wall or window, that the Leopard plant stands house conditions admirably; that if you keep some plants, like the Silk Oak, in a north window they will grow so much more slowly that they will not get unwieldy in size.

The book gives in very concise form suggestions for possible indoor gardens and for growing of single plants both for those with a very limited amount of space, and also for those who are fortunate enough to have sun porches or gardens in which to propagate plants in the summer, which are to be brought indoors in the winter.

The illustrations add their impetus to the persuasive powers of the authors in leading one to think that the very popular and modern "art" of indoor gardening is intriguingly simple and worthy of trial.

FARIDA A. WILEY.

THE ANATOMY OF THE FRILLED SHARK *CHLAMYDOSELACHUS ANGUINEUS* GARMAN

----- by Bertram G. Smith

American Museum of Natural History, New York, 1937, \$3.50.

THE frilled shark (*Chlamydozelachus anguineus* Garman) from the time of its first description by Garman in 1885 has never failed to arouse the interest of students of the evolution of the vertebrates, partly on account of its reputation of being the most primitive of the true fishes. To the late Dr. Bashford Dean, Curator of Fishes, *Chlamydozelachus* was always a subject of prime importance and in the course of his extended investigations of the embryology of the oldest living types of fishes he collected material for his studies on the natural history, anatomy and embryology of this very rare deep water shark. Unfortunately Doctor Dean died before the completion of his ichthyological work, leaving behind him a great deal of material which has formed the nucleus of the Bashford Dean Memorial Volume: *Archaic Fishes*. Of this several parts have already been published by the Museum under the able direction of Dr. E. W. Gudger, the editor of the series. "The Natural History of the Frilled Shark, *Chlamydozelachus anguineus*" by E. W. Gudger and B. G. Smith was published last year. The recently issued general and detailed anatomy of this fish by B. G. Smith is dealt with in an excellent work of 505 quarto pages and 7 plates. It would be difficult to find anywhere a more satisfactory presentation of the results of

many investigations, fairly and compactly stated, abundantly illustrated and illuminated by the author's wide and intensive knowledge of human and comparative anatomy. Not the least important are the author's closing words:

"My outstanding impression of the frilled shark is that it presents a strange assemblage of characters ranging from very primitive to highly differentiated. In this, it is comparable to *Chimaera*, though the latter is specialized in a decidedly different way. *Chlamydozelachus* is a deep-sea adaptation of some rather ancient type of shark, and is now waging a losing battle in the struggle for existence."

W. K. G.

AXIAL BIFURCATION IN SERPENTS: An Historical Survey of Serpent Monsters Having Part of the Axial Skeleton Duplicated

----- by Bert Cunningham

Duke University Press, \$2.50

DOUBTLESS man's interest in double-headed monsters and similar malformations dates back well into prehistoric times. From the era of Aristotle, through the period when P. T. Barnum capitalized on this interest, right down to the present day Sunday supplement, scientific and lay writers alike have found it to be of interest to describe and to depict "Siamese twins," two-headed calves, four-legged chickens and similar anomalies resulting from abnormal development.

Cunningham laboriously has gone through an extensive and scattered literature, including books, periodicals and newspapers, to assemble reports of 225 "fairly well authenticated" cases of axial duplication in serpents. These he has catalogued and briefly annotated with accounts arranged chronologically under four main categories, with a fifth to include indeterminate specimens. Inasmuch as every conceivable combination of the axial skeletons has been reported, groups are based somewhat arbitrarily upon the degree of furcation. Twelve plates include small reproductions of 234 figures taken from published as well as from original photographs, X-ray photographs and drawings.

The chief value of this little book, which is comprised of seventy pages of text and forty-seven pages devoted to bibliography, indexes and plates, lies in the historical treatment of subject matter. The evolution of biological thought is apparent through the chronological arrangement of accounts in the text. Benjamin Franklin is quoted as believing that a snake with two heads represented a distinct genus because it was perfectly formed, because it appeared to be an adult (which it probably was not), and because another snake entirely similar had been found! As recent as 1919 a popular "scientific" magazine carried an account which stated that "A pair of double-headed snakes will have all double-headed offsprings" (*sic*), despite the fact that as early as 1826 that emi-

H. G. WELLS says of



"This is a book to read and then browse over and over again to keep for reference. It is a book to own."

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by H. E. TOWNER COSTON

The mysterious teeming life beneath the surface of streams and ponds is described fully and graphically in this volume, and the delicate balance of conditions on which life depends made vividly understandable. Fully illustrated with many unusual photographs.

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This volume in the *Design of Life* series had two predecessors that are also available:

Design in Nature by James Ritchie
Fully illustrated \$2.00

Ways of Birds by Thora Stowell
Fully illustrated \$2.00

at all bookstores

Charles Scribner's Sons, New York

nest dabbler in nearly all branches of science, Samuel Latham Mitchell, had contradicted any notion of hereditary dicephalism with a paper in which he advanced the theory that two-headed serpents were universally monsters.*

The behavior of two-headed snakes is of some general interest. In most cases one head appears to dominate the control over bodily movements, whereas in other cases what appears to be a struggle between the heads for control has been described. The majority of dicephalic monsters ingest food through only one head. More commonly both heads drink. Apparently no attempt has been made to correlate behavior with the internal anatomy, and duplicated parts do not always correspond to the external dichotomy. One monster having two three-inch necks is reported to have had one head swallow the other. However, at present little of scientific value has been achieved from such observations.

The author states that it is not his intention to enter into a discussion of the theoretical significances of axial duplication, but he is willing to offer the suggestion that probably it is due to "multiple organization centers" on single or on two embryonic discs. Such an explanation would appear to be of little help; the real question would seem to be: What is the origin of the separate "organization centers" or of the separate discs?

Teratology makes its main contribution to biological theory, not through the mere description of monsters, but rather through the light it is able to throw upon our understanding of normal developmental processes. Inasmuch as the present book is concerned but little with embryology it has failed in this respect. Nor has any attempt been made to explain the neurological or physiological phenomena, or to correlate these with the morphology. Only the geographic distribution has been summarized and the result is meaningless from any biological viewpoint.

The book is no more than the title implies—an historical survey of one type of monster. P. T. Barnum would have found it very interesting.

C. M. BOGERT.

THE BIRDS OF TROPICAL WEST AFRICA, with Special Reference to those of the Gambia, Sierra Leone, the Gold Coast, and Nigeria. Vol. IV

- - by David Armitage Bannerman
Crown Agents for the Colonies, London.
22s 6d.

THE first volume of Doctor Bannerman's great work on the avifauna of West Africa appeared in 1930, and the fourth in 1937. There will be six in all. Here will be found as complete an account of every species and race of bird living in that vast area as it is possible to give at the present time, and the total

*This is the more surprising, since Mitchell once testified at a trial that a white woman gave birth to a dark child because her husband had spilled ink in her shoe.

number of named forms is estimated at 1502.

There are keys to identification, full descriptions, measurements, statements of range, and extensive notes on behavior. The fourteen plates in color are by Roland Green, George E. Lodge, and Henry Jones, and there are also abundant illustrations in black and white by H. Gronvold and Roland Green, as well as an excellent map of the Gambia.

The work is designed both for specialists in museums and for residents in the West African colonies who desire to become acquainted with birds.

The first three of these includes all the orders of birds except the Passeriformes, commonly called perching birds, which in tropical countries usually compose about one-half of all the species. Volume IV takes up eight families, those of the broadbills, pittas, wagtails and pipits, babblers, bulbuls, flycatchers, and thrushes. Many of these are exceptionally difficult to identify in the field, and for this reason Doctor Bannerman has prepared very thorough illustrated keys to the genera, as well as keys to the species in each genus. The subject is a large and difficult one, and these splendid volumes do all that is possible to simplify it. Again Doctor Bannerman deserves our warmest thanks and congratulations.

JAMES P. CHAPIN.

A HISTORY OF THE BUSINESS MAN

- - - - - by Miriam Beard

Macmillan, \$5.00

THE FOLKLORE OF CAPITALISM

- - - - - by Thurman Arnold

Yale University Press, \$3.00

IN the midst of an era wherein literature about business and government is produced exclusively by people writing in a high fever, Miss Beard and Professor Arnold have chosen to turn out the coolest brace of books pertaining to these subjects that have appeared in some time. Their attitude differs so strikingly from that of their colleagues that it seems attributable to nothing short of a significant social change of heart.

What Miss Beard has managed to give us is, in essence, a panoramic view of human reactions to the profit motive, refracted by a series of differing circumstances. Aside from such tangible factors as geographical location and the development of tools, these circumstances were mainly concerned with "climates of opinion", a phrase borrowed from Professor Arnold. For example, there were only two major epochs in which a particular nationality of business men was accepted by compatriots as the salt of the earth—in which a climate of opinion completely favorable to its aims and achievements obtained. The first of these epochs occurred when the Dutch business oligarchs of the 17th century didn't care which king claimed what colonies so long as the produce of these colonies was transported in Dutch vessels at a handsome profit. The

second occurred in the United States under the administration of the late Calvin Coolidge. Because there were no powerful opposition groups in these two cultures, they have left us a picture of the business man at the height of his power. And of the two, Miss Beard feels that it was the Dutchmen who felt the least restraint. In that little principality of bogs and fogs, circumstances combined to give the business man a "climate" the like of which he may very possibly never see again. Almost everywhere else from ancient Greece and Rome down to Victorian England and Civil War America, the business man was pitted in an endless struggle with the agrarians—the international landed gentry from whose ranks nearly all of the great military and political heroes celebrated by the traditional historian have emerged. It is these heroes—the Caesars, the Louis XIVs and the Napoleons—who make up the façade of history. And, with Holland and America excepted, it was only when he bought his way into the landed class, like the great banking family Medici, that the business man could find a place in their Pantheon.

* * * *

In his time, Thurman W. Arnold has been Mayor of a town in Wyoming and Dean of a law school. He can, therefore, look at the contemporary problems of government from both the "academic" and the "practical" points of view. He has done so in the *Folklore of Capitalism* and his conclusion is that, with all its faults, the "practical" is the only way that comes anywhere near making sense.

You are doubtless aware by this time that Professor Arnold has calmly described all our legal and economic learning as nothing more nor less than "theology." His approach to the present day "American scene" is that of an anthropologist in the Malay Archipelago where, he says, professional anthropologists have been wasting their time because far more interesting propitiatory ritual has been conducted by the United States Supreme Court (our priestly hierarchy) than will ever be discovered in a primitive society.

In the year 1885, the "priestly hierarchy" then functioning decided that an organization owned by many people, comprising thousands of employees and operating over a vast geographic as well as economic area under the name of a corporation, could call itself a single person. Of course, Mr. Arnold points out, a corporation isn't a single person and the fact that we have gone along for half a century pretending that it is constitutes the key ceremony—the vital article of faith—in our highly elaborate modern folklore. The author describes many other ceremonies and articles of faith which occupy secondary and tertiary positions under this key ceremony. Thus arranged, they symbolize the political and economic taboos of twentieth century Americans coolly, impersonally, and wittily analyzed.

I am not going to enumerate these taboos. They can be heard in the smoking cars of commuter's trains and seen in the anti-Roosevelt polemics of the daily press. They are produced by the fierce conflict between a practical need and an outmoded "theology"—a "theology" which,

Mr. Arnold feels, will have to go. The times are crying for a new "theology" (Professor Arnold does not believe any age ever produces ultimate truths) and until we get one, we will have to be satisfied with personalities. Miss Beard calls Hitler, Mussolini, and Roosevelt "depression phenomena." Professor Arnold refers to them as personalities arising to fill a vacuum left by the receding of an old theology.

D. R. B.

A PRAIRIE GROVE

— by Donald Culross Peattie

Simon and Schuster, \$2.50

IMAGINATIVE human beings often express a heartfelt wish to have known, through actual contact, something of the everyday lives and experiences of long vanished forbears. Often this desire may approach true nostalgia and will include a definite longing for glimpses of conditions in primeval times and for the sight of landscapes never to be viewed. In America we are not far removed, in years, from the keen-eyed early European explorers who had the privilege of paddling down our then clear rivers. The creak of ox-carts, toiling ever westward, may still echo in the ears of those among us who will listen. The parents of aborigines living in our country today could remember the first white men to enter many a western region.

Donald Culross Peattie sings of bygone American days when he tells of his Prairie Grove. He speaks of sunsets, clouded by the wings of passenger pigeons, of earth that shook beneath the mighty tread of buffalo, and of Indians who gazed with wonder at the glittering accoutrement of the French missionary. Often he paints a vivid picture, and again he peers through shadowy forest aisles striving to recapture a past that eludes even his far-seeing eye. This is the story of the advancing parade of human history and of the receding pageant of a once abundant wild-life population, brought to focus upon Mr. Peattie's island grove, nestled on the broad plains of Illinois.

Aspiration and perspiration play their parts wherein the white settlers came upon and conquered the grove. The reader will walk upon trails that gradually widen and eventually will follow the "Ridge Road that turns past Alison's Barns." He will witness the transformation of the land, smell the black earth turned to the sky by adventuring plows, and dream of things that were the dreams of the pioneers.

Virility and fertility walked hand in hand where the Goodner family were concerned. The Goodners are Mr. Peattie's principal actors, a hardy folk who left a New England home to carve their way in the Prairie Grove. Wolves howled nearby, during that first long winter when a relentless icy wind had its way with the newly fashioned house. Goodners were, in the main, courageous, steadfast and philosophical. The young men and women yearned for goals that could never be attained, even as they do today. Unemployment was an empty phrase. The land provided work enough for all. Hun-

ger, in its many forms, urged the family on, making a naturalist of one lad and a business man of another. There was the wife who was loved and the one who was deserted. Human behavior followed its ageless pattern against a virginial, wilderness background.

Mr. Peattie becomes novelist, historian and poet as he spins the warmly colored thread of his tale. His certain knowledge of wild nature, combined with his ability to interpret her moods, adds a charm, the like of which has entered few accounts of the days and ways of our American pioneers.

WILLIAM H. CARR.

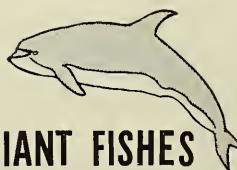
GIANT FISHES, WHALES AND DOLPHINS

by J. R. Norman and F. C. Fraser

W. W. Norton and Co., \$4.00

WHALES and porpoises (some or all of which are also called dolphins in literature more than in the vernacular of the sea) are so closely associated in the popular mind with large fishes that it is appropriate to have a book of reference including both, and at the same time clearly pointing out the great differences between them. Whales and porpoises of course are not fishes but warm-blooded air breathing mammals. We have here a scholarly compilation of descriptions of

An altogether fascinating guide book



GIANT FISHES WHALES & DOLPHINS

by J. R. NORMAN, F.L.S., F.Z.S.

and F. C. FRASER, B.S.C., F.Z.S.

Both of the Dept. of Zoology, British Museum

Written to meet the demand for authoritative information about the giant creatures of the deep, this book is filled to overflowing with facts that at times verge on the bizarre. For instance, inside the flipper of a whale is a bone structure corresponding to that of humans, with upper arm, forearm, wrist and finger bones . . . sharks are covered with teeth instead of scales . . . torpedo fish carry around electric batteries almost identical in principle with man-made storage batteries, and electrocute their prey! Contains a key to species, more than 100 line drawings and 8 full-color plates. \$4.00

W. W. NORTON & CO.
70 FIFTH AVE., NEW YORK

the principal fishes which ordinarily grow to six feet or more in length, of certain smaller forms associated with them, and of all the well known Cetacea. There are also interesting facts about each animal, such as the pursuit of flying-fishes by the dolphin (the fish this time, not the mammal), history and methods of the whaling industry, swordfish and marlins ramming their spears into ships, and that the maximum time a finned whale remains under water is probably about half an hour. The part on fishes has been written by Norman, that on whales and dolphins by Fraser, and the abundant illustrations including eight colored plates are by Colonel W. P. C. Tenison. These add greatly to the attractiveness of the volume, and also further its purpose of enabling the voyager or seashore dweller correctly to identify these animals.

In recommending a book of reference a reviewer should also point out its limitations, due in this case largely to the nature of the subject matter treated. Various large fishes such as certain kinds of sharks, the tunnies, the marlins, are represented by several very similar and imperfectly known species the relationships of which are still matters of opinion on which no one can speak with authority. It also seems that the authors have no familiarity with the animals in life comparable with the breadth of their knowledge of them in the museum and in literature; characteristics and comparisons of their behavior are often not drawn as clearly as they might have been. For instance we have a color plate to illustrate different porpoises in which *Delphinus* and *Phocaena* are both shown leaping clear of the waves. There is no mention of the fact that the former, a characteristic animal of the blue water of the high seas, does so customarily, several members of a school often being in the air at once, and that the latter, characteristically a coastwise and harbor form, by contrast in coming to the surface usually just rolls its back into view for an instant with scarcely a ripple. However, anyone intrigued by the life of the sea, and who is not who sails upon its waters, will find matter of interest and value in this small volume.

J. T. N.

BIRD STUDIES AT OLD CAPE MAY

— by Witmer Stone

Delaware Valley Ornithological Club, Academy of Natural Sciences of Philadelphia. 2 vols. \$6.50

CAPE MAY, at the southern end of New Jersey, has long been famed for its bird-life. The lay of the land, the influence of the wind on southbound migrants, the diversified nature of the land itself, with shore and upland habitats in close proximity, combine to create exceptional conditions during the migratory as well as resident periods of the birds' year. Attracted by the opportunities the region offers both for killing and observing birds, gunners and ornithologists have visited it for many years to pursue their respective callings. Each group has left records and

in Witmer Stone has been found the man to assemble them and place them with his own. An historian and bird student, he loves the past as the father of the present and the present for itself. Friend of laymen as well as of bird men, his personality has stimulated cooperation. Student of books as well as of birds, he is as familiar with the work of others as he is with his own. In short, both desire and experience have qualified the author for his task and he has risen to the occasion.

Stone first visited Cape May in 1890 and it has occupied a place in his affections and interests ever since. His intensive field studies were made between 1916 and 1930. The seven years remaining before the appearance of these notable volumes formed, so to speak, a period of incubation, during which the researches and speculations of later students have been considered with his own, making a well-developed subjective and objective presentation of the whole.

An introduction of 70 pages treats of "Old Cape May," the bird-life of the various distinctive habitats represented. "The Changing Bird Life of the Cape," "Bird Migration at the Cape," etc.

Then follow some 800 pages of individual "bird studies." They extend in size from a paragraph to as much as a dozen pages. Formal treatment is avoided and the result is a readable description of the bird in its haunts, accounts of personal field experiences and liberal quotations from the records of others. Special chapters are devoted to "Autumn Hawk Flights" and "Shore Birds."

In appearance the book is worthy of its contents. There are two hundred and forty photographs, taken chiefly by Wharton Huber and W. L. Baily; many show the country; many show birds in their haunts and thus serve a double purpose. Pen-and-ink tail-pieces, by Fletcher Street and Herbert Brown, of characteristic scenes and vegetation serve also to create an atmosphere that envelops the book. Most of the "studies" are headed by a cut, from a third to half a page, from the pen of Earl L. Poole. Admirable in art, technique, and ornithology, they are adequate portraits of the species they illustrate. In short, no one knowing the history of this work can fail to share the author's pleasure at the completion of what has, in truth, been a labor of love. With the aid of many colleagues he has erected a monument to "Old Cape May and its bird-life."

FRANK M. CHAPMAN.

WARDENS OF THE WILD
- - - - - by T. C. Bridges

Dodd, Mead and Company, \$2.50

A SPLENDID bird's-eye view of some of the world's outstanding wild life sanctuaries and parks is presented in this colorful, carefully written book. Men who superintend numerous wilderness areas play a large part in the general accounts of the management, policy, and maintenance relating to preserves in North America, Europe, Africa, Asia, Australia and New Zealand. Mr. Bridges has chosen his material with excellent discernment

and has gathered information directly from park and sanctuary directors, from scientific departments and agencies of the various governments, and also from accredited explorers, reputable conservationists and other authorities on wild life preservation. In the main, the picture is a heartening one. The number of areas reserved for the use of wild creatures are increasing annually and, of equal, or perhaps of even greater importance, are added armies of trained and sympathetic men who are being given places of command in these same regions.

The author relates tales of human interest throughout his well illustrated volume. There are fascinating stories of elephants, gorillas, buffalo, and many other animals. One of the most satisfactory single chapters on the beaver we have ever read, is presented under the title of, "A Man Who Loves Beaver." The description of beaver habits is contained in the first six pages and forms an account so well balanced that it should be a model for animal biographers.

Wardens of the Wild deserves a large and appreciative audience. We hope that it will be read by those who are responsible for the formation of new parks in our own country, and we are certain that those who visit our wild life preserves will gain much through a study of this book.

WILLIAM H. CARR.

THIS IS OUR WORLD

- - - - - by Paul B. Sears

University of Oklahoma Press, \$2.50

IN *This Is Our World* Paul B. Sears brings together a gift for writing, a fine scientific mind trained in botany and ecology, and a sense of humor to explain to the reader how he happens to be alive today.

Man is merely a part of the complex of nature. He does not stand outside it. However, as he does not realize this, he is living in a destructive fashion way beyond his means. To show this the author describes the world and gives its history; tells of the surface on which life evolves; the atmosphere which it breathes; the water which is a part of it. In this medium life developed as the valleys were exalted and the mountains lowered in geological development. This process produced soil which was cultivated by many organisms until it could support large plant forms and the organisms which accompany them. Life evolved until this planet contained the necessary prerequisites for the development of prehensile-thumbed man. In the earlier civilizations he lived pretty generally in an environmental equilibrium. When he did not, the situation was remedied by war, disease, and migration.

Today man is breaking the universal order. Technology is squandering his legacy; science is loosening the control disease had over population; the advanced science of killing is consuming resources which required millions of years to generate. Man's civilization is a maladjustment of the environment. Will his ingenuity eliminate him from the earth

or can he make peace with the environment in which he lives?

Paul Sears writes: "All of the great continents bear witness with abandoned cities, mines, and fields, drifting dunes and denuded hills, to the fact that human activity can persist in a suicidal course of doing the things that it has always done, in the way that it is accustomed to do them until the means of survival themselves are exhausted." This is the problem that faces all scientists and constructive thinkers: can man be dissuaded from dismantling minutely and self-righteously the land and sea that make his existence possible?

Mr. Sears suggests as his solution an impossible ideal of democracy which consists of a God-like leader who will educate his people into a "debating camp" which will lead to the necessary decisions. The author's plan is based on a great reasonableness of man, the lack of which caused his trouble. However, the germ of the author's method is sound and that is to teach. This his book does well, making the reader aware that man is an ingredient of nature and nature will have the last word.

JOHN N. CARLEY.

ARCTIC HARPOONER

- - - - - by Robert Ferguson

Edited by Leslie Dalrymple Stair
University of Pennsylvania Press, \$2.00

THE full history of whaling, starting with the pursuit and capture of the world's largest game by men equipped with stone age weapons, has still to be written. When the time comes for someone to attempt this most thrilling of subjects, *Arctic Harpooner* will provide some of the necessary human interest for that phase of American whaling when small vessels sailed from New England ports up through Hudson Straits to the vicinity of Southampton Island where they wintered before returning the following year.

This narrative is based on Robert Ferguson's diary of a sixteen-month voyage in the years 1878 to 79 supplemented by his record of a previous voyage in 1876 to the same region.

JUNIUS BIRD.

THE CALL OF THE KOALA

- - - - - by Ambrose Pratt

KOALA

- - - - - by Charles Barrett

Robertson and Mullens, Ltd., Melbourne,
6/- and 2/- respectively.

THE people of Australia are becoming conscious of the remarkable native fauna of that continent, and these two books are devoted to the unique koala, from the viewpoint of conservation.

Both are rather small volumes, the larger being a little over a hundred pages and the smaller a third of that. "The Call of the Koala" is the more complete, and it gives a good general description of

Continued on page 313

THE HIGHEST MOUNTAIN EVER CLIMBED

Continued from page 250

The route led us up around the base of an enormous rock buttress and onto the narrow southern ridge near the snow line at 18,000 feet. The ridge soon became broken into a series of abrupt steps where bands of sedimentary rock became outcrops. Camp I was placed at 19,500 feet, immediately below the first step. There was some difficulty for the ridge was narrow and on one side precipitous; in fact, we were to find throughout the entire ascent that there was scarcely a spot large enough for our 7 x 7 foot tents along the entire 10,000-foot face of the peak, so steep were its slopes. In every case it was necessary to build elaborate platforms to support the tents.

The entire party worked to provision Camp I, then I retired to the Base Camp, as predetermined, to take charge of the porters there and to do some surveying of the surrounding topography.* Two of our Sherpas were already ill, one with a serious form of dysentery of which he died three weeks later.

"Leap-frog" progress

It was essential to be roped together while moving anywhere on the steep mountainside, and the party was divided into teams or "ropes" of two or three men each. One team went ahead to prospect the route for the next stage while the others worked to provision the camp below. When the site for a camp had been found, a tent was placed there and immediately occupied by a fresh reconnaissance party, the first team dropping back to the easier life of the support. This new advance rope again pushed ahead while the main body, with the aid of porters, fully stocked the higher camp. At night the support party returned to the lower camp to avoid congestion and to consume supplies at as low an elevation as possible. With seven climbers it was practical to give each team two days with the support to one of pushing on in advance. Inasmuch as we were relying purely on acclimatization rather than on oxygen to cope with the altitude, we felt it necessary to spend two nights at each successive camp before going higher.

This system of "leap frogging" was carried out until we had established Camp V, a light bivouac at 23,500 feet, 16 days after leaving the Base Camp. The Sherpa porters had been taken out of the fight one by one through illness and snowblindness until, by Camp III, all the work of carrying ahead had to be borne by the white climbers. The route was sometimes definitely hazardous and often far from obvious. In a number of cases it took several attempts to surmount the next obstacle. Our pace was slow of necessity, weather conditions were not always favorable, and at Camp III (21,200 feet) the entire party was beset by a severe storm that kept them huddled in their tents for two days, while a wild wind raged across the upper cliffs of the mountain and battered the camp mercilessly. All of these

factors, while not unforeseen, conspired to delay the final assault.

On August 26, Houston and Odell, two of the ablest men, left Camp V on the first bid for the summit. The upper slopes of Nanda Devi are composed of great crags of rock several thousand feet high. The angle of these slopes is great and the rocks were covered with a thin coating of ice and snow. Progress for the climbers was slow and a feasible route difficult to find. The two men reached a point at nearly 25,000 feet before they were forced to turn back due to poor snow conditions.

That night at Camp V Houston was taken ill with food-poisoning and at that great height the smallest ailment can be a serious matter. Houston was forced to withdraw and retired to Camp IV. On August 27, Tilman came up from below to join Odell and replace him. Deciding that Camp V was too low to make a really effective try at the summit, they carried a camp 500 feet higher on the following day. They were now at 24,200 feet or within 1500 feet of their goal.

August 29th dawned clear, Odell and Tilman got away from Camp VI at 6:00 a.m. as the sun came up. The support party stood ready at Camp IV to offer assistance in case of emergency. The two climbers followed the route of the previous attempt and, making better time, approached the last rock wall below the summit by 1:00 p.m. In ascending this wall by a narrow gully, they dislodged an avalanche which slithered away over the 8000-foot precipice below, narrowly missing them.

Where no man had trod

At last, at 3:00 p.m. after 9 hours of weary climbing, Odell and Tilman stood on the summit. We had won! But Nanda Devi had not been "conquered." We well knew that with such weapons as storm, cliff and avalanche we had won only at Nanda Devi's pleasure; we felt more humble and less proud that she had permitted it.

The summit was a gently rounded cone of wind-packed snow. Though the weather was comparatively mild, the view was somewhat spoiled by broken banks of monsoon cloud. During the hour spent on top, when the two men felt as far removed from the earth beneath as if they had been on Mars, they photographed the distant peaks and noted the temperature, which was 15° F. Descent to Camp VI was cautious but more rapid, and by sunset the two men were once more in their sleeping bags. On the 30th Odell and Tilman descended to Camp IV and, on the way, were met by the support party ascending to see how they had fared. By the 1st of September the entire mountain had been abandoned and all hands were safely at the Base Camp, 21 days after leaving it and 11 months since the first plans had been laid in faraway Cambridge. Da Namgith returned with the porters from Joshimath on the appointed day.

Inasmuch as the principal objective of the Expedition had been accomplished, there remained little to be done. Odell had obtained much valuable data on the geology of the Nanda Devi complex (not yet published). My survey map was completed within a few days. There was still

one more piece of exploration to carry out—the crossing of the eastern rim by a new col attempted by Dr. T. G. Longstaff in 1905. This crossing was then accomplished by Houston and Tilman who, after some difficult ice-climbing, crossed the col and thence returned to Ranikhet by this new route. The remainder of the party left the Sanctuary by the Rishi Gorge, now a little less fearsome due to our familiarity with it. There remained only the writing of reports and the publication of our photographs and material to complete the picture of this Himalayan expedition.

And so, perhaps, one can see how it all took place. As to why—perhaps these pages can convey something of the challenge and thrill of exploring and ascending a remote mountain giant, of standing where no other human has ever stood. Still somehow this does not fully explain what drew us to the lovelly valley paradise and its great ice-capped peaks. It cannot all be told for there are things in the hearts of men which words do not portray.

YOUR NEW BOOKS

Continued from page 312

the animal. A popularized life history is the story of Edward, a pet koala. The food-problems involved in keeping the species in captivity, or on reservations are discussed at length. Eucalyptus leaves and bark are the only natural food, and no substitute is possible for any length of time. It is then found that certain species of Eucalyptus are poisonous, and even in the preferred species the young leaves, and occasionally the older leaves, contain poisonous amounts of prussic acid. These facts necessitate large reservations and varied conditions to preserve the koala. Mr. Pratt has contributed considerably to the solution of these problems and deserves the gratitude of all those interested in wild life.

Chapters on the classification, relationship, evolution, and anatomy of the koala are written in popular language, and are somewhat weaker than the natural history sections.

The second book is written more in the style of the Sunday supplement, but may be the more effective in enlisting popular interest in the koala and the support for its conservation.

Both books are well illustrated with photographs of koalas in various poses. Those in the "Call of the Koala" are especially attractive. JOHN ERIC HILL.

CHINESE CERAMIC GLAZES

— — — — — By A. L. Hetherington

Cambridge; at the University Press; New York: Macmillan Company, \$3.00

WITH the broadened fields of scientific investigation, the situation often arises of science overlapping with art, and from the meeting there results an increased interest in and appreciation of the objects formerly viewed from the artistic standpoint alone. This book is a splendid example of the co-operative endeavors of the chemist in answering the questions which inevitably arise in the minds of lovers of Chinese porcelains as

Continued on page 320

*See *American Geographical Review*, "Mapping in the Nanda Devi Basin," by A. B. Emmons, January, 1938. Vol. 28, pp. 59-62.

Quiz—

This is a

This is

This is

This is

**all four
AND MORE
ON A
ROCK ISLAND
vacation**

Stalagmites in awe-inspiring Carlsbad Caverns—Bridal Veil Falls at beautiful Yosemite—Pikes Peak in the majestic Colorado Rockies—Old Faithful Geyser at interesting Yellowstone—see them all on a glorious trip through the West this year.

Summer fares are low via the **De Luxe Golden State Limited** or the **Economy-Luxury Californian**—Chicago to California—and the **Rocky Mountain Limited** to Colorado.

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Route of the Rockets

LETTERS

Continued from page 304

afternoon they said "In the near future we shall have a broadcast from Pitcairn Island." Can you tell me anything about it? I hope you will be the man at this end.

Please pardon this long letter from a garrulous old lady who has no one left with whom she can talk of Pitcairn Island. Again let me tell you how much I have enjoyed your book.

Thomaston, Me. CAROLINE J. TOBEY.

* * *

Dear Mrs. Tobey:

It was a delight to receive your very kind letter, not only for the nice things you wrote about my book but also because of your interesting recollections of Pitcairn.

Of the names you mentioned, Simon Young, Rosalind Young, Thursday October Christian, Russell McCoy are all dead. But Eunice Jane Lawrence Young is still living. And the little twins Rose and Lily are now grown up elderly ladies. Rose married Parkins Christian and is a grandmother. You will find her picture opposite page 152 in my book. She is seated on the extreme left, her husband is on the extreme right holding their grandchild. Between them is old Mrs. Butler, Rose's mother who was then about 86 or 87. Mrs. Butler was Sophia McCoy. She married a sailor, named Butler, who died soon after. Standing are Rose's and Parkins' daughter and her husband.

The other twin, Lily, married a Warren and is the mother of Burley Warren whose picture is also reproduced in my book. The pretty young girl you noticed is, I believe, one of the Warren girls.

I do remember a Carrie Jordan, but unfortunately my records are not accessible as I write so that I cannot verify her genealogy for you. I do, however, recollect that there was no one living by that name on Pitcairn at present.

The anchor of the *Bounty* was dredged up several years ago but as far as I know it was never purchased by any New York museum. The islanders were anxious to sell it and hoped to get a generous sum for it from some historical institution.

Music has remained a favorite pastime of the islanders, and they still prefer hymns to secular tunes. Our collection of symphonic and light classical music hardly interested them at all. Indeed, when we left the island, the entire population came out in their boats and sang "Shall We Meet by the Beautiful River."

It was a great pleasure to hear from you, Mrs. Tobey, and if you will permit it, I should like to publish your letter in NATURAL HISTORY many of whose readers are extremely interested in Pitcairn and would enjoy reading your recollections of a visit so long ago.

With kindest wishes.

HARRY L. SHAPIRO.

American Museum.

* * *

Dear Dr. Shapiro:

Thank you for your very interesting letter, telling me of the Pitcairn folk. It brought back things I have not thought of for many years.

We had collected quantities of clothing, books, magazines and sewing materials from San Francisco friends, or rather,



Dude Ranches

WYOMING

PATON RANCH, a home, on a mountain stream in the foothills of the Big Horn Mountains, where you may relax and rest. Everything that life on a ranch affords. Gentle horses, wholesome food, attractive cabins. Guest capacity limited, rates reasonable. Address William Paton, Shell, Wyoming.

CL BAR, Cora, Wyoming, in the Upper Green River Valley. A large, old stock ranch offers you Cabins—with baths, fireplace, electricity. Lake or Stream Fishing. Best food—Excellent mounts—Comfort. Accommodations limited. References required. Winter address: Dr. E. S. Lauzer, Rock Springs, Wyoming.

CALIFORNIA

DIAMOND D RANCH, Willits, Calif. 14,000 acre cattle ranch, rugged beautiful country, 15 miles from the ocean. Modern accommodations. Excellent food. Riding, swimming, tennis, fishing and hunting. Rates \$50.00 per week. For descriptive folder write: W. E. Hiatt, Box 517, Willits, Calif.

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SADDLE POCKET RANCH, Shaler P. O., Colorado. Old time mountain cattle ranch in western Colorado. Riding, swimming, tennis. Pack trips. Fine trout streams on ranch. Swimming. Modern accommodations. 12th guest season. References exchanged. \$40 up. R. D. Salisbury.

they had been brought to the ship with the request that we give them to the islanders. On the 2nd day out late in the afternoon we sighted the island and caught the "land smell."

At five the next morning I heard the mate speak to my father and I went on deck to find we were close to the island and a boat was coming off. When she was within hail a man shouted "Good morning Captain —". We have been looking for you Captain — told us you were coming." The boat was loaded with fruit and vegetables and the Governor brought two huge bouquets, one for Mother and one for me. After we had shaken hands all round he said "I've got a mail for you Carrie." The mail proved to be a letter from Miss Freeman who had stopped there a few weeks before.

After a hurried breakfast we got into the boat and were soon in Bounty Bay. I was carried ashore on the shoulders of two of the young men, but Father waded with the rest of them.

Apparently everybody on the island knew all about us for they all called me by my first name and seemed to take a good deal of interest in hearing about the San Francisco people who had sent the organ. The oldest person on the island and the only one living of the second generation was Mrs. Mills. She was a very old woman, but greatly interested in us. We came back to the ship with quantities of fruit. The lemons were very thick skinned, much larger than ours and extremely acid. We brought pumpkins back to New York where we had a Pitcairn pumpkin pie (not square ones) for our friends.

CAROLINE J. TOBEY.

THE COVER THIS MONTH

The cover design of this issue of *NATURAL HISTORY* is from a painting by Oqwa Pi, of New Mexico, one of the most famous Indian painters. The dancing men are represented in generalized ceremonial costume, as seen in the Green Corn Dance and other ceremonies, and are carrying rattles and sprigs of evergreen. The stepped design is derived from the symbols for cloud terraces, the steps between the earth and the home of the rain gods.

The original painting is from the large collection of Miss Amelia Elizabeth White, which has recently been divided among a number of museums and art institutes throughout the country. Miss White's collection, which was started in 1912, was a truly heroic assemblage of modern Indian material and has been a major force in the stimulation of nation-wide interest in American Indian arts. Following its exposition at the Grand Central Art Galleries in 1930 the collection toured the country for two years and was later distributed under Miss White's direction. At the American Museum of Natural History, which is among the many institutions to profit by Miss White's gift, the original painting is on display among many other examples, which visitors to the Museum may find interesting.

Animals FOR SALE



A Wide Selection of these
Attractive Reproductions
in Bronze Priced at

35¢

The

BOOKSHOP

American Museum of Natural History
Central Park West at 79th Street
NEW YORK, N. Y.

HOW TO SEE TWICE AS MUCH OF MEXICO!



Pottery markets
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If you want to really see the *heart* of Mexico in *comfort* and *safety*, you'll decide to go by train. From your Pullman seat in a modern, air-conditioned train, you'll see the Mexico that's off the beaten path—a thrilling pageant of colorful native life that changes with every mile.

When you go to Mexico City by train, plan to go *one way* and *return another*, using the West Coast Route one way. By doing this, you'll see TWICE AS MUCH of Mexico as you would by going and returning on the same route. You'll add lazy Mazatlan to your trip, and the enchanting mar-



kets of Guadalajara. (Stopover at Guaymas for a bit of deep-sea fishing or loafing at Southern Pacific's new Hotel Playa de Cortés.)



Mazatlan, on the West Coast of Mexico

Going to California? ADD MEXICO TO YOUR TRIP

If you're going to California on Southern Pacific this year, you can add a side trip to Mexico City and back for very little extra rail fare!

FREE! Join the 250,000 people who have enjoyed Southern Pacific's famous booklet, *I've Been to Mexico*. For your free copy, write O. P. Bartlett, Dept. NH-4, 310 South Michigan Avenue, Chicago. If you're interested in deep-sea fishing, ask for the booklet, *A True Fish Story*.

Southern Pacific

Who, When, Where

APRIL CALENDAR OF ENTERTAINMENT

On these pages will be found a calendar of museum events in metropolitan New York for April. It is hoped that this list will enable those at a distance who contemplate a visit to New York to plan more efficiently, and that those who live in or near the city may be able to choose lectures and other activities that fit their needs or interests.

CHARLES RUSSELL.

Curator of the Department of Education, American Museum of Natural History

General Information

AMERICAN MUSEUM OF NATURAL HISTORY

Central Park West at 79th Street,

New York City

Hours: Daily 9:00 a. m. to 5:00 p. m. Sunday 1:00 p. m. to 5:00 p. m. Open holidays 9:00 a. m. to 5:00 p. m.

Admission Free.

AQUARIUM

Battery Park, New York City

Hours: Daily 9:00 a. m. to 5:00 p. m.

Admission Free.

BROOKLYN BOTANIC GARDEN

1000 Washington Avenue, Brooklyn

Hours: Daily from 9:00 a. m. until dark. Sundays from 10:00 a. m. Conservatories open from 10:00 a. m. until 4:00 p. m.

Admission Free.

BROOKLYN MUSEUM

Eastern Parkway and Washington Avenue, Brooklyn

Hours: Daily 10:00 a. m. to 5:00 p. m. Saturdays and holidays 10:00 a. m. to 6:00 p. m. Sundays 2:00 p. m. to 6:00 p. m.

Admission Free, except Mondays and Fridays, when charge is 25¢ for adults and 10¢ for children

APRIL 1

AMERICAN MUSEUM OF NATURAL HISTORY

10:30 a. m.—Lecture—"Saving Our Wild Life," by Agnes K. Saunders—Museum Auditorium—Open to Public.

BROOKLYN MUSEUM

4:00 p. m.—Lecture—"Recent Painting in Canada," by Walter Abell—Classroom A—Admission 25¢.

FRICK COLLECTION

3:00 p. m.—Lecture—"The Giorgionesque Mood," by Mr. Fosburgh—Lecture Room—Open to Public.

APRIL 2

AMERICAN MUSEUM OF NATURAL HISTORY

10:30 a. m.—Lecture—"Wild Life Adventures," by Allan D. Cruickshank—Open to children of members.

2:00 p. m.—Motion Picture—"Our Poet-Naturalist, John Burroughs"—Museum Auditorium—Open to Public.

BROOKLYN MUSEUM

3:00 p. m.—Dance Recital—Matons, Gilmour and Experimental Group—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Thomas Gainsborough," by Mr. Ritchie—Lecture Room—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Olympia: the Meeting Place of Hellas," by Mr. Shaw—Lecture Hall—Open to Public.

2:00 p. m.—Lecture—"Courbet and the Modern Attitude," by Miss Abbot—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"Diggings into the Past; The Daily Life of the Egyptians—Ancient and Modern,"—Lecture Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

1:15 p. m. & 3:30 p. m.—Motion picture—"Feeding New York"—Open to Public.

NEW YORK BOTANICAL GARDEN

3:00 p. m.—Lecture—"Photography in the Garden," by Fleda Griffith—Open to Public.

FRICK COLLECTION

1 East 70th Street, New York City

Hours: Weekdays 10:00 a. m. to 5:00 p. m. Admission Free.

METROPOLITAN MUSEUM OF ART

Fifth Avenue and 82nd Street, New York City

Hours: Daily 10:00 a. m. to 5:00 p. m. Saturdays and holidays 10:00 a. m. to 5:00 p. m. Sundays 1:00 p. m. to 5:00 p. m.

Admission Free, except Mondays and Fridays, when charge is 25¢.

MUSEUM OF THE AMERICAN INDIAN

Broadway and 155th Street, New York City

Hours: Daily 2:00 p. m. to 5:00 p. m. Sunday 1:00 p. m. to 5:00 p. m.

Admission Free.

MUSEUM OF THE CITY OF NEW YORK

Fifth Avenue and 103rd Street, New York City

Hours: Daily 10:00 a. m. to 5:00 p. m. Saturdays and holidays 10:00 a. m. to 6:00 p. m. Sundays 1:00 p. m. to 6:00 p. m. Closed Tuesdays.

Admission Free, except Monday, when charge is 25¢.

MUSEUM OF MODERN ART

11 West 53rd Street, New York City

APRIL 3

BROOKLYN MUSEUM

2:30 p. m.—Organ Recital—Robert Leech Bedford—Sculpture Court—Open to Public.

4:00 p. m.—Concert by Symphony Orchestra—Sculpture Court—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Tours of the Collections: "Late Gothic Art," by Miss Freeman—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"Tapestries and How They Are Made; A Visit to the Armor Gallery; The Pottery Maker"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Color Study: Ceramics," by Miss Cornell—Classroom K—Open to Public.

3:15 p. m.—Tours of the Collections: "Tapestries," by Miss Freeman—Main Hall—Open to Public.

SPECIAL EXHIBITS

As announced in last month's NATURAL HISTORY, the International Photographic Exhibit goes on display in Education Hall from April 13-28 showing the work of masters of camera technique from all over the world.

"Spring Is Here" is the title of an outdoor exhibit in Memorial Hall during April. Against a background of spring flowers and shrubs, masses of frogs' eggs will transform into wriggling tadpoles and giant silkworms will emerge from their silken cocoons.

A new gorilla from West Africa—the rare species *Gorilla gorilla gorilla*—has been placed on exhibition on the third floor of the Museum. This splendid beast, mounted by Robert H. Rockwell of the Museum's Preparation Department, was presented to the Museum by Mr. E. Kenneth Hoyt.

Hours: Daily 10:00 a. m. to 6:00 p. m. Sundays 12:00 p. m. to 6:00 p. m.

Admission Free on Monday, other days 25¢.

MUSEUM OF SCIENCE AND INDUSTRY

RCA Building, Radio City, New York City

Hours: Daily 10:00 a. m. to 5:00 p. m. Sundays 2:00 p. m. to 5:00 p. m.

Admission 25¢ (Free to teachers with classes)

NEW YORK BOTANICAL GARDEN

Bronx Park, Bronx, N. Y.

Hours: Museum and Conservatories open daily 10:00 a. m. to 4:30 p. m.

Admission Free.

STATEN ISLAND MUSEUM

Stuyvesant Place and Wall Street, St. George, Staten Island

Hours: Daily 10:00 a. m. to 5:00 p. m. Sunday 2:00 p. m. to 5:00 p. m.

Admission Free.

WHITNEY MUSEUM OF AMERICAN ART

8-12 West 8th Street, New York City

Hours: Daily 10:00 a. m. to 6:00 p. m. Sunday 2:00 p. m. to 6:00 p. m. Closed Monday.

Admission Free.

APRIL 5

AMERICAN MUSEUM OF NATURAL HISTORY

3:50 p. m.—Lecture—"Dogs—Origin of Present Day Breeds," by John R. Saunders—Museum Auditorium—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Color in Dress I," by Miss Cornell—Classroom K—Open to Public.

2:30 p. m.—Motion Picture—"The Temples and Tombs of Ancient Egypt; Drypoint—a Demonstration"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Design in Metal," by Miss Cornell—Classroom K—Open to Public.

4:00 p. m.—Lecture—"The Manchu Patrons," by Miss Duncan—Main Hall—Open to Public.

APRIL 6

AMERICAN MUSEUM OF NATURAL HISTORY

4:10 p. m.—Lecture—"Building a School Nature Trail," by Miss Wiley—Open to Members.

FRICK COLLECTION

3:00 p. m.—Lecture—"William Blake," by Mr. Ritchie—Lecture Room—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Silver," by Miss Bradford—Main Hall—Open to Public.

4:00 p. m.—Lecture—"Italian Interpretation of Imported Northern Forms," by Leopold Arnaud—Lecture Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

3:30 p. m.—Motion Picture—"To Serve New York"—Open to Public.

APRIL 7

AMERICAN MUSEUM OF NATURAL HISTORY

8:15 p. m.—Lecture—"Diving Among Sea Killers," by Captain John D. Craig—Museum Auditorium—Open to Members.

FRICK COLLECTION

3:00 p. m.—Lecture—"Francesco Laurana," by Mr. Fosburgh—Lecture Room—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"The Early Christian Period," by Mr. Grier—Main Hall—Open to Public.

NATURAL HISTORY, APRIL, 1938

APRIL 8

AMERICAN MUSEUM OF NATURAL HISTORY
10:30 a. m.—Lecture—"Boys and Girls of China," by Grace F. Ramsey—Museum Auditorium—Open to Public.

BROOKLYN MUSEUM

4:00 p. m.—Lecture—"The Art of Honore Daumier," by Carl O. Schniewind—Classroom A—Admission 25¢.

FRICK COLLECTION

3:00 p. m.—Lecture—"Turner and Constable," by Mr. Ritchie—Lecture Room—Open to Public.

APRIL 9

AMERICAN MUSEUM OF NATURAL HISTORY

10:30 a. m.—Lecture—"Audubon, the Bird Lover," by Grace F. Ramsey—Museum Auditorium—Open to Public.

2:00 p. m.—Motion Picture—"Dixie"—Museum Auditorium—Open to Public.

BROOKLYN MUSEUM

3:00 p. m.—Music Recital—The New School Chorus, Arthur Lief, Director—Sculpture Court—Open to Public.

3:00 p. m.—Lecture—"History of Music and Its Parallels in Visual Art," by Mr. LeVita—Classroom A—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Titian," by Mr. Fosburgh—Lecture Room—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"The Goody Citadel of Athens," by Mr. Shaw—Lecture Hall—Open to Public.

2:00 p. m.—Lecture—"Manet and Degas," by Miss Abbot—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"The Pottery Maker; Eve of the Revolution (Yale Chronicles of America Photoplay)"—Lecture Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

1:15 & 3:30 p. m.—Motion Picture—"Columbus"—Open to Public.

NEW YORK BOTANICAL GARDEN

3:00 p. m.—Lecture—"The Garden's First Year," by T. H. Everett—Open to Public.

APRIL 10

BROOKLYN MUSEUM

2:30 p. m.—Organ Recital—Robert Leech Bedell—Sculpture Court—Open to Public.

4:00 p. m.—Concert by Symphony Band—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"The Venetian Decorative Painters," by Mr. Fosburgh—Lecture Room—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Tours of the Collections: "English Furniture of the XVII Century," by Miss Bradish—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"The Making of a Bronze Statue; The Etchers Art"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Ceramic Design," by R. Guy Cowan—Classroom K—Open to Public.

3:15 p. m.—Tours of Collections: "American Furniture to 1750," by Miss Bradish—Main Hall—Open to Public.

APRIL 12

AMERICAN MUSEUM OF NATURAL HISTORY

3:50 p. m.—Lecture—"Underseas on Coral Reefs," by Dr. Roy W. Miner—Museum Auditorium—Open to Public.

8:15 p. m.—Lecture—"Life of the Open Ocean," by Dr. Roy W. Miner—Roosevelt Memorial Lecture Room—Open to Members.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Color in Dress II," by Miss Cornell—Classroom K—Open to Public.

2:30 p. m.—Motion Picture—"The Pottery Maker; The American Wing"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Design in Pottery," by Miss Cornell—Classroom K—Open to Public.

4:00 p. m.—Lecture—"Last of the Manchus," by Miss Duncan—Main Hall—Open to Public.

APRIL 13

AMERICAN MUSEUM OF NATURAL HISTORY

4:10 p. m.—Lecture—"Spring in the Nature Room," by Mrs. Burns—Open to Members.

FRICK COLLECTION

3:00 p. m.—Lecture—"Benvenuto Cellini," by Mr. Fosburgh—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Factors of Sculpture," by Mr. Taggart—Main Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

3:30 p. m.—Motion Picture—"Little Dutch Tulip Girl"—Open to Public.

APRIL 14

FRICK COLLECTION

3:00 p. m.—Lecture—"Chardin," by Mr. Ritchie—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"The Carolingian Period," by Mr. Grier—Main Hall—Open to Public.

PLANETARIUM Schedule for APRIL

★

"The Mysterious Moon"

Weekdays—2:00, 3:30, and 8:30 P. M.

Saturdays—11:00 A. M., 1:00, 2:00, 3:00, 4:00, 5:00 and 8:30 P. M.

Sundays & Holidays—2:00, 3:00, 4:00, 5:00 and 8:30 P. M.

General Admission Evenings 35¢

Reserved Seat " 50¢

General Admission Evenings 35¢

Reserved Seat " 60¢

General Admission for Children under 17, accompanied by adults, 15¢ at all times. (No reduced price for reserved seats occupied by children.) Children under 5 not admitted. Doors close on the hour. Special facilities for the hard of hearing.

APRIL 15

BROOKLYN MUSEUM

4:00 p. m.—Lecture—"Techniques in Oriental Art," by Laurence P. Roberts—Classroom A—Admission 25¢.

FRICK COLLECTION

3:00 p. m.—Lecture—"Giovanni Bologna," by Mr. Fosburgh—Open to Public.

APRIL 16

AMERICAN MUSEUM OF NATURAL HISTORY

2:00 p. m.—Motion Picture—"Eve of the Revolution"—Museum Auditorium—Open to Public.

BROOKLYN MUSEUM

10:30 a. m.—Hindu Festival—International Institute—Sculpture Court—Open to Public.

3:00 p. m.—Dance Recital—Edda Hiller and Ann Agin—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Antoine Watteau," by Mr. Ritchie—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Lecture—"The Leaders of Impressionism," by Miss Abbot—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"The Making of Wrought Iron; A Visit to the Armor Galleries; Firearms of Our Forefathers"—Lecture Hall—Open to Public.

NEW YORK BOTANICAL GARDEN

3:00 p. m.—Lecture—"Hayfever Plants of America," by R. P. Wodehouse—Open to Public.

STATEN ISLAND MUSEUM

3:30 p. m.—Lecture illustrated by motion pictures—"Wild Animals of Kruger National Park," by Dr. A. H. Thomasson—Open to Public.

APRIL 17

BROOKLYN MUSEUM

2:30 p. m.—Organ Recital—Robert Leech Bedell—Sculpture Court—Open to Public.

4:00 p. m.—Concert by Symphony Orchestra—Sculpture Court—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Tours of the Collections: "Furniture: the Period of Louis XIV," by Mr. Busselle—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"Tapestries and How They Are Made; The Making of a Stained Glass Window"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Color in Dress," by Miss Cornell—Classroom K—Open to Public.

3:15 p. m.—Tours of the Collections: "Furniture: the Period of Louis XV," by Mr. Busselle—Main Hall—Open to Public.

APRIL 19

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Color in Dress III," by Miss Cornell—Classroom K—Open to Public.

2:30 p. m.—Motion Picture—"The Etcher's Art; The Making of a Bronze Statue"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Design in Glass," by Miss Cornell—Classroom K—Open to Public.

4:00 p. m.—Lecture—"Writing and Printing," by Miss Duncan—Main Hall—Open to Public.

APRIL 20

FRICK COLLECTION

3:00 p. m.—Lecture—"Jacques Louis David," by Mr. Ritchie—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Environment of Sculpture," by Mr. Taggart—Main Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

3:30 p. m.—Motion Picture—"The Port of New York"—Open to Public.

APRIL 21

FRICK COLLECTION

3:00 p. m.—Lecture—"Furniture in the Collection," by Mr. Fosburgh—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"The Romanesque Period," by Mr. Grier—Main Hall—Open to Public.

APRIL 22

FRICK COLLECTION

3:00 p. m.—Lecture—"Eugene Delacroix," by Mr. Ritchie—Open to Public.

APRIL 23

AMERICAN MUSEUM OF NATURAL HISTORY

2:00 p. m.—Motion Picture—"Medieval Masters,"—Museum Auditorium—Open to Public.

4:00 p. m.—Lecture—"What Is a Gem?" by Herbert P. Whitlock (Lantern Slides)—Room 319, Roosevelt Memorial—Open to Public.

BROOKLYN MUSEUM

3:00 p. m.—Lecture—"History of Music and Its Parallels in Visual Art," by Mr. LeVita—Classroom A—Open to Public.

FRICK COLLECTION

3:00 p. m. Lecture—"The Caffers, Clodion, and Falconet," by Mr. Fosburgh—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Lecture—"Cézanne and XX Century Trends," by Miss Abbot—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"Diggings Into the Past; The Daily Life of the Egyptians—Ancient and Modern"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Benozzo Gozzoli," by Jane B. Walker—(For the deafened who read the lips)—Classroom B—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

1:15 and 3:30 p. m.—Motion Picture—"Peter Stuyvesant"—Open to Public.

NEW YORK BOTANICAL GARDEN

3:00 p. m.—Lecture—"Our City's Parks and Playgrounds," by Allyn R. Jennings—Open to Public.

APRIL 24

BROOKLYN MUSEUM

2:30 p. m.—Organ Recital—Robert Leech Bedell—Sculpture Court—Open to Public.
4:00 p. m.—Concert by Symphony Orchestra—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—“Jean Antoine Houdon,” by Mr. Fosburgh—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Tours of the Collections: “Furniture: The Period of Queen Anne and Chippendale,” by Mr. Busselle—Main Hall—Open to Public.
2:30 p. m.—Motion Picture—“Firearms of Our Forefathers: The American Wing”—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—“Textile Design and Modern Dress Fabrics,” by Robert Schey—Classroom K—Open to Public.

3:15 p. m.—Tours of the Collections: “American Colonial Furniture After 1750,” by Mr. Busselle—Main Hall—Open to Public.

APRIL 26

AMERICAN MUSEUM OF NATURAL HISTORY

3:50 p. m.—Lecture—“Birds and Their Relation to Man,” by Paul B. Mann—Museum Auditorium—Open to Public.

8:15 p. m.—Lecture—“Adaptation of Living Organisms to Ocean Depths,” by Dr. Roy W. Miner—Roosevelt Memorial Lecture Room—Open to Members.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—“Color in Painting I,” by Miss Cornell—Classroom K—Open to Public.

2:30 p. m.—Motion Picture—Tapestries and How They Are Made: Behind the Scenes in the Metropolitan Museum: The Making of Wrought Iron”—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—“Design in Dress,” by Miss Cornell—Classroom K—Open to Public.

4:00 p. m.—Lecture—“Saints and Sinners,” by Miss Duncan—Main Hall—Open to Public.

APRIL 27

AMERICAN MUSEUM OF NATURAL HISTORY

4:10 p. m.—Lecture—“Trees and Shrubs,” by Miss Wiley—Open to Members.

FRICK COLLECTION

3:00 p. m.—Lecture—“Italian Painting in the Collection,” by Mr. Fosburgh—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—“Sculpture of the Past,” by Mr. Taggart—Main Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

3:30 p. m.—Motion Picture—“Historic Governors Island”—Open to Public

APRIL 28

FRICK COLLECTION

3:00 p. m.—Lecture—“English Painting in the Collection,” by Mr. Ritchie—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—“The Early Gothic Period,” by Mr. Grier—Main Hall—Open to Public.

GUIDE SERVICE

The following institutions offer free lecture tours of their collections:

AMERICAN MUSEUM OF NATURAL HISTORY

Wednesdays, Fridays and Saturdays at 11:00 a. m. and 3:00 p. m. Meeting Place: 2nd Floor, Roosevelt Memorial.

METROPOLITAN MUSEUM OF ART

Wednesdays and Thursdays at 2:00 p. m. Tuesdays at 12:00 m. Meeting Place: Main Hall.

MUSEUM OF MODERN ART

Daily at 11:00 a. m., 1:30 p. m., 3:00 p. m., and 4:30 p. m.

APRIL 29

AMERICAN MUSEUM OF NATURAL HISTORY

10:30 a. m.—Lecture—“Alaska,” by Marguerite Newgarden—Museum Auditorium—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—“Italian Sculpture in the Collection,” by Mr. Fosburgh—Open to Public.

APRIL 30

AMERICAN MUSEUM OF NATURAL HISTORY

2:00 p. m.—Motion Picture—“Galapagos”—Museum Auditorium—Open to Public.

4:00 p. m.—Lecture—“Diamonds: From Mine to Market,” by Herbert P. Whitlock (Lantern Slides)—Room 319, Roosevelt Memorial—Open to Public.

BROOKLYN MUSEUM

3:00 p. m.—Dance Recital—Dorothy Barret—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—“French Painting, 18th Century, in the Collection,” by Mr. Ritchie—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—“Art of the IV Century,” by Mr. Shaw—Lecture Hall—Open to Public.

2:00 p. m.—Lecture—“Etruscan Sculpture,” by Mr. Shaw—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—“The Pottery Maker; The Making of a Stained-Glass Window”—Lecture Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

1:15 and 3:30 p. m.—Motion Picture—“Declaration of Independence”—Open to Public.

NEW YORK BOTANICAL GARDEN

3:00 p. m.—Lecture—“Where Spring Flowers Grow about New York,” by E. J. Alexander—Open to Public.

APRIL RADIO PROGRAMS

EVERY DAY

10:00 a. m.—Organ Recital—Station WNYC—BROOKLYN MUSEUM.

APRIL 1

3:15 p. m.—“The Child’s Garden,” by Ellen Eddy Shaw—Station WNYC—BROOKLYN BOTANIC GARDEN.

APRIL 4

4:30 p. m.—“Today’s Natural History,” by Robert R. Coles—Station WNYC—AMERICAN MUSEUM OF NATURAL HISTORY.

5:15 p. m.—“New Horizons—Restless Earth”—Dr. Harold E. Vokes—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 6

3:30 p. m.—“Music of the Spheres,” by Marian Lockwood—Station WQXR—AMERICAN MUSEUM OF NATURAL HISTORY.

5:15 p. m.—“Exploring Space” (Popular Astronomy)—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 7

11:30 a. m.—“Primitive Homes,” by John R. Saunders—Station WHN—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 11

4:30 p. m.—“Today’s Natural History,” by Robert R. Coles—Station WNYC—AMERICAN MUSEUM OF NATURAL HISTORY.

5:15 p. m.—“New Horizons—Trailsides Pets,” by William H. Carr—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 13

3:30 p. m.—“Music of the Spheres,” by Marian Lockwood—Station WQXR—AMERICAN MUSEUM OF NATURAL HISTORY.

5:15 p. m.—“Exploring Space (Popular Astronomy)—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 14

11:30 a. m.—“Primitive Clothing,” by John R. Saunders—Station WHN—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 15

3:15 p. m.—“Plant Evergreens Now”—Montague Free—Station WNYC—BROOKLYN BOTANIC GARDEN.

APRIL 18

4:30 p. m.—“Today’s Natural History,” by Robert R. Coles—Station WNYC—AMERICAN MUSEUM OF NATURAL HISTORY.

5:15 p. m.—“New Horizons—Exploring Ocean Airways” by William Van Dusen—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 20

3:30 p. m.—“Music of the Spheres,” by Marian Lockwood—Station WQXR—AMERICAN MUSEUM OF NATURAL HISTORY.

5:15 p. m.—“Exploring Space (Popular Astronomy)—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 21

11:30 a. m.—“Primitive Cooking,” by John R. Saunders—Station WHN—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 25

4:30 p. m.—“Today’s Natural History,” by Robert R. Coles—Station WNYC—AMERICAN MUSEUM OF NATURAL HISTORY.

5:15 p. m.—“New Horizons—Fish Tales,” by Mr. Van Campen Heilner—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 26

2:15 p. m.—“Garden Favorites: Magnolias,” by Charles F. Dotney—Station WOR—BROOKLYN BOTANIC GARDEN.

APRIL 27

3:30 p. m.—“Music of the Spheres,” by Marian Lockwood—Station WQXR—AMERICAN MUSEUM OF NATURAL HISTORY.

5:15 p. m.—“Exploring Space (Popular Astronomy)—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 28

11:30 a. m.—“Primitive Transportation,” by John R. Saunders—Station WHN—AMERICAN MUSEUM OF NATURAL HISTORY.

APRIL 29

3:15 p. m.—“Spring Flowers at the Brooklyn Botanic Garden,” by Arthur Harcourt Graves—Station WNYC—BROOKLYN BOTANIC GARDEN.

WHAT IT TAKES

TO MAKE

A POUND OF

ALUMINUM



BAUXITE. The commonly used ore. It is found in many countries. Ours comes from Arkansas and Dutch Guiana. Aluminum is present, not as metal, but in the form of complicated chemical compounds. All the following raw materials are needed to get the aluminum out:



SODA ASH AND LIME. Add water to these, heat the solution and digest the *bauxite* in it. Aluminum compounds dissolve. Impurities are left behind as mud. From the filtered solution, something called *aluminum hydrate* is separated. Heat the *hydrate* to drive out water, and you have alumina, a white powder, chemically labelled as aluminum oxide. It sounds simple, but this is really a very technical, expensive process.



CRYOLITE. Translucent "Ice-rock," found naturally only in distant Greenland, but also made synthetically. To get the actual metal out of the *alumina*, the powder first has to be dissolved in a bath of molten *cryolite*.



COKE, TAR AND PITCH. Metallic aluminum is made in a steel pot thickly lined with *carbon*, which contains the molten bath of *cryolite* and dissolved alumina. Carbon blocks are hung in the bath, and a heavy electrical current is passed from the blocks through the bath to the lining of the pot. This current changes the oxide, *alumina*, to the metal, *aluminum*. Carbon blocks and linings are made from *coke*, *tar* and *pitch*.

A total of nine pounds of the foregoing materials are required to make one pound of aluminum. But other things are equally vital:



FUEL. The process of getting *alumina* from *bauxite* uses 22,000 cubic feet of gas, or equivalent coal, for each ton of final metal. Coal also is consumed in baking the carbon blocks used in the reduction pots.



ELECTRICITY. Twelve kilowatt-hours of electrical energy must be generated to produce one pound of aluminum. The energy needed for a ton of aluminum would supply the electrical needs of the average home for thirty-five years. That is why we have invested millions in dams, reservoirs and power houses, through which, when running full, flows enough water to supply the needs of 92 cities the size of New York.



TRANSPORTATION. From mine to refinery to reduction plant our aluminum-in-the-making has to be shipped and reshipped to locations where all these raw materials are best available. Our transportation bill, just for getting aluminum made, was more than \$5,000,000 last year.



LABOR. Labor is important in every one of these operations. Wages constitute the largest item in the cost of making aluminum.



SKILL. Every step of the process must be supervised and co-ordinated by men who "know-how." Hundreds of men in laboratories must continually check not only the raw materials but every pound of metal produced.



MONEY. The wherewithal which develops mines, builds and equips the necessary refinery and reduction plants, the dams, reservoirs and power houses, must be available.

All these are needed to make virgin aluminum, one of the most difficult of all commercial metals to extract from nature. Would you have imagined it?

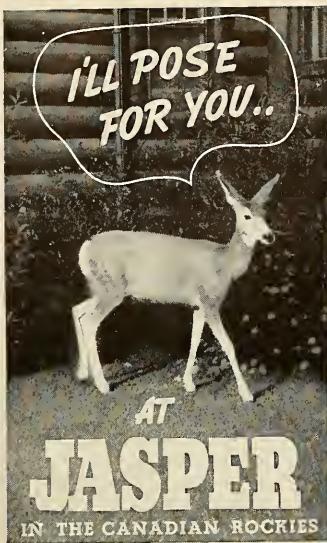


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A TICKET TO THE ARCTIC

Continued from page 292

panies he may learn of an unscheduled flight to deliver freight or to pick up a trapper or prospector at some isolated camp on the barrens or in the bush somewhere between Hudson Bay and the MacKenzie River. He may go along, then, with a native paddle and portage his way back to civilization. Such a vacation is recommended only to an athletic young fellow with powers of endurance, who can look after himself and live alone and like it, eat raw meat and fish, starve stoically for a few days at a time or

longer and be willing to risk disaster. The Northwest Territories administration naturally frowns on this sort of derring-do and, if it gets wind of it, exacts a bond from the would-be adventurer before granting him permission to enter the country, to finance the anticipated search for him or his body. There is good reason for this, too, for many a skeleton lies bleaching on the barrens.

For the present, then, Mr. Vermonter, you had better not be too ambitious unless you propose to make a career of exploration. So, in the words of the radio announcer: "Don't delay—simply go to your nearest travel agency and buy your ticket to the Arctic now!"

YOUR NEW BOOKS

Continued from page 313

to the methods and mediums used by the ancient potters in securing the glorious reds of the ox-blood glazes, or the reasons for the superiority of the Sung celadons. The already amazingly beautiful results of the early artisans become even more astonishing when the readers of this book, the amplification of a series of lectures delivered by the author at the Courtauld Institute of Arts (London) in February of 1937, learn that the glazer's palette was derived mainly from the compounds of the two metals, iron and copper.

Iron alone, fired in an atmosphere low in oxygen, gave the gray-greens of the celadons, though the suggestion is made that the accidental addition of traces of lithium, coming from the materials used in the glaze, may here have played a part. The browns of the temmoku ware resulted from a furnace atmosphere containing abundant oxygen, but the addition of greater amounts of alkali to the glaze gave finishes ranging to a light yellow. The iron series was extended late in the Ming and in the Manchu dynasties when an iron- to coral-red was added as an on-glaze effect in which the low-fired, finely divided iron oxide glaze was coated over a high-fired white glaze and lightly heated to fix it before it dissolved.

The copper story is even more fascinating and the account of the delicacy of the conditions necessary for the production of the turquoise-blue glaze would alone be sufficient to impart an appreciation for the skill of the early Chinese workers not felt before by even the connoisseur.

Following the major chapters, the author discusses some of the pigments in later use; the cobalt, manganese and gold glazes. Crackle and opalescence are described and the resourceful workers' transformation of these porcelain deficits into artistic assets. He closes with a useful glossary of Chinese names and terms and a brief bibliography.

The author has drawn freely from the work of Dr. J. W. Mellor, a recognized authority on ceramic glazes, and gives in a readable and popular style the essentials of a real scientific investigation; sufficient information on the subject to answer the questions of the collector and student of Chinese porcelains without going into the more technical aspects. It is well illustrated with seven halftones and seven color plates and is an essential work for all who are interested in Chinese porcelains. The bibliography lists two other works on different aspects of Chinese ceramics by the same author, as well as the magnificently illustrated "Art of the Chinese Potter," written in 1923, with R. L. Hobson.

FREDERICK H. POUGH.

Adventure in April



Put raincoats and rubbers on the children and let them take a walk in the spring rain. If they know what creatures to look for, it will be an exciting adventure. The April issue of The Junior Natural History Magazine will take your child on an educational springtime expedition.

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n Spots & Drought • New Guinea Types • A New Cave

FIFTY CENTS



Why can this man HAVE MORE and WORK LESS?

THIS is the mystery man. Dozens of foreign commissions have traveled thousands of miles to find out why it is that, working only 40 hours a week, he can buy an electric refrigerator with one month's pay. Workers in foreign lands labor many more hours a week, but to them a refrigerator is a luxury beyond their reach.

Why is it this typical American workman can buy an automobile with $4\frac{1}{2}$ months' pay? Few workers abroad have automobiles—it would take all they could earn in a year to buy one. Why is it that American workers enjoy radios, telephones, electric lights, and hundreds of other comforts and conveniences almost unknown to foreign workers? Why do we enjoy the highest standard of living known in any country?

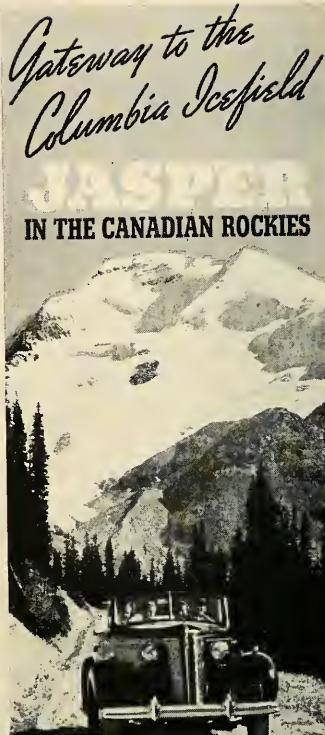
The American worker has more because he produces more. And he produces more because he has abundant power to help him—power that increases his own ability manyfold.

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

F. TRUBEE DAVISON, President

ROY CHAPMAN ANDREWS, Sc.D., Director

VOLUME XLI—No. 5

★ ★ ★ ★

MAY, 1938

Forest Sunshine.....	Cover Design
<i>Adapted from a photograph by Philip D. Gendreau</i>	
The Forest Trinity.....	Frontispiece 324
Green Gold.....	R. Neumann Lefebvre 325
<i>Help is needed to make our forests everlasting</i>	
Sun-spots in the News.....	Wm. H. Barton, Jr. 344
<i>These huge, electrical "whirlwinds" affect climate, crops, health and even the stock market</i>	
The Story of Amber.....	Willy Ley 351
<i>The sea gold of the Baltic</i>	
The Face of Peking Woman.....	Franz Weidenreich 358
<i>Latest developments regarding our celebrated ape-like relative</i>	
A Round Trip to Davy Jones' Locker.....	Wm. H. Hand, Jr. 361
<i>The story of a man who went down with a fish</i>	
Native Life in New Guinea.....	Nash Nejame 363
<i>A photo-series of some tribes of a little-known island</i>	
Exploring a New Cave.....	R. M. P. Burnet 374
<i>Amid unearthly splendors remains of animals and pottery 1000 years old are found</i>	
The Indoor Explorer.....	D. R. Barton 385
Your New Books.....	388
Science in the Field and in the Laboratory.....	392

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TREES • FLOWERS • AND MOUNTAINS

The forest trinity of the Pacific Northwest: an American heritage which must be preserved as a recreational and economic asset by wider public appreciation of the principles of Conservation.

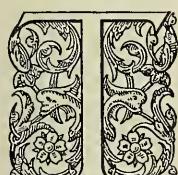
GREEN GOLD

By R. NEUMANN LEFEBVRE



Probably the first representation of America's green gold: the trees along Florida's coast, which inspired Ponce de Leon to name the country as he did. Drawn in 1564 by

Jacques Le Moynes de Morgues. From the Rare Book Collection of the Library of Congress. (Reproduced from *American Forests Magazine*, by courtesy of the American Forestry Ass'n.)



IMBER!" the woodsman shrills his warning as 200-foot giants crash. Your forefathers' greeting to the noble forests was "Hail and Farewell"; now your help is needed to make our forests everlasting

OLD lumberjacks of the Pacific Northwest indulged in many chuckles, not to mention a few sturdy and picturesque expletives, at the expense of the first sawmills in that forested section. The mills "had only one fault—apparently beyond cure—of turning out boards thicker at one end than at the other, and sometimes thicker in the middle than at either end."*

But in spite of their ludicrous imperfections, these same little sawmills, first established in 1827-28 at the trading post of Vancouver, marked the beginning of the final depletion of the nation's primeval forests.

The significance of this fact is noteworthy, for man's greatest necessity, next to food, is wood.

Three hundred years ago the nation had 822 million acres in forests. This was 42% or nearly half of its land area. Our forests lay—two vital covers of green—one from the Atlantic seaboard over the tops of the Appalachians to the great plains, the other beyond the prairies, reaching up the Rockies and down to the Pacific Ocean. Today, although approximately one-third of our land area has some kind of timber growth, only one-fourth is capable of producing in commercial quantities, and most of the nation's original magnificent virgin forests have

*"History of the State of Washington," Edmond S. Meany.

passed their peak of production. However, in this connection it should be borne in mind that a mature or over-mature forest does not produce as much wood per acre per year as does a young, vigorously growing forest, in spite of the fact that a young forest is never as impressive as is the mature forest.

How did this tremendous transformation of our forests take place?

We find our first clue in a definition of a forest from Blackstone—"Forest is waste ground belonging to the king, replenished with all manner of beasts of chase or venery, which are under the king's protection for the sake of his royal recreation and delight." This, of course, refers to the European forests of the feudal period—a period when the word liberty had little meaning. The people of that time would no more have thought of logging off a section of their overlord's deer park than we would of helping ourselves to the flowers in the White House garden. If they did they probably would have suffered the most severe punishment.

Free for all

Now imagine the psychological effect on our ancestors of the sudden opening up of a New World. It appears to them as one vast, unattended deer park—theirs for the taking. From these comparatively small and rigidly protected forests of the European monarchs, to the prolific free forests of America was a momentous transition.

Vikings first found these American forests, perhaps when Bjarni Heriulfsson and his crew, sailing from Iceland in 986, sighted the American mainland. Leif Ericson, in 1003, took specimens of the trees away with him after he had touched American shores. And De Soto, in 1539, wrote of American forests: "And trees grow in the fields without planting and dressing them, and are as big and rancke as though they grew in gardens digged and watered."

Later Hudson, the seaman, and Champlain stood on the threshold of the splendid forests that enriched New York and Pennsylvania. Pushing farther into virgin territory, hardy emigrants found the mixed hardwoods of the Lake States. And Captain Meriwether Lewis described the huge forests blanketing the Rockies, in 1804-06. So the forests became a constructive force of the highest significance in the nation's life. As epitomized by Theodore Roosevelt: "American democracy was born of no theorists' dream; it was not carried in the *Sarah Constant* to Virginia, nor in the *Mayflower* to Plymouth. It came out of the American forest, and it gained strength each time it touched a new frontier. . . ."

The noble forests bequeathed their virility and Nature's elemental strength and goodness, as a heritage to all America.

The Indians and early explorers left this great natural heritage practically untouched, but with the advent of the settlers, released from the repressions of feudal Europe, the depletion of the forests began.

A valuation of our forests is contained in this statement: "A proposal that the United States abandon one-sixth of her territory to foreign powers would be met with instant disapproval. American people would sacrifice millions of lives and countless treasure to prevent such a surrender.

"Yet practically as great a loss in national wealth and income would be suffered if even the privately owned forest lands of the country were allowed gradually to lapse into an idle, unproductive condition, and if the forests of other countries were called upon to furnish the wood that American forests have hitherto produced."*

Fortunately, this comparison illustrates a hypothetical situation which does not exist and which in all probability will not exist, since the government and the lumber industry are cooperating more and more for the conservation and productive uses of forest resources.

The devastation of forests is the result of forest and land exploitation, over-expansion of agriculture, aggressive industrialism, forest fires, unregulated grazing, insufficient knowledge of the specific values of certain woods, destruction by insects, fungi, wild and domestic animals, and by weather phenomena, lack of adequate reforestation, and a general apathy on the part of the American public toward Conservation.

A reckless era

At one time the public domain amounted to 1,400,000,000 acres. Then gradually millions of acres of the finest timber devolved into private hands. According to some authorities, a review of federal forest policies presents a picture of which we can be none too proud, "a reckless and wasteful destruction of magnificent forests, and of flagrant and notorious theft of valuable lands."† After 150 years as custodian of the public domain, Congress has disposed of more than two-thirds of the entire original area. Clearing of land for agricultural purposes caused the destruction of 150 million acres of our original forests. Fifty million acres given out by Congress for settlement and home building are today coming back "tax-delinquent" with forests

*"America and the World's Woodpile," Raphael Zon and Wm. Sparhawk, (1928).

†"U. S. Forest Policy," John Ise—(Yale University Press, 1920).

and other natural resources wrecked—a new public domain, which will be a burden on posterity for years to come.

Mitigating circumstances include the fact that it was not always possible to gauge the value of homestead and forest lands. For instance, a western railroad once exchanged Dakota farmland worth \$10 per acre for western forest land valued at \$1 per acre. At present this same Dakota land, through drought, has become practically valueless while the western forest-land's value is estimated at \$200 per acre.*

Lumbering, necessarily destructive to forests, has reduced millions of acres of productive forest to wasteland. The habit, all too prevalent in the past, of exploiting forests as if they were an unreplenishable resource like minerals, has led to the disastrous practice of "timber mining" in place of "timber cropping." This has been permitted largely through the public's lax attitude toward the preservation of the nation's trees.

For, in the past, forests were taken very much for granted. In fact, they were regarded at one time much as northwestern pioneers regarded real estate after a land boom had flattened out. On one such occasion, a pioneer of the State of Washington remarked: "Say, John, you know that Mr. Newcomer? Well, I just sold him a lot, and when the fellow wasn't looking, I slipped two extra lots into the deed." However, tree wastage is not always avoidable.

But with the United States, during 1925-29, depleting its usable forests twice as fast as they were being replenished, and the total drain on soft timber about five times greater than its growth, the need for forest conservation became acute.†

The turn

Since 1930, depletion conditions have changed. The annual drain from lumber cutting has been so reduced that it is equal to, and possibly even less than the annual growth; incidentally, a condition not very encouraging from a business standpoint. But irrespective of the present economic situation within the lumber industry, it is generally conceded that no longer is there the question, "Will forest conservation work?" The welfare of the American people and their high standard of living depend upon judicious forestry. A vigorous and continuous conservation program is now one of the needs of the nation.

Our era of "man-made" forests is at hand.

*Frank Reed, Simpson Logging Co., Seattle.

†Copeland Forestry Report, "A National Plan for American Forestry," 73d Congress, 1st Session, Senate Document 12 (1933).

This involves reforestation—the renewing of forest cover on denuded land by natural seeding or artificial planting. Artificial reforestation is no modern wizardry. China had a reforestation department 2000 years ago, as did the ancient Greeks. And when Gifford Pinchot, staunch advocate of planned forestry, said, "Next to the earth itself, the forest is the most powerful servant of man," he was merely reiterating succinctly a fact acknowledged by the ages. Trees have always been friends of man.

A study of trees means more than the study of dendrology, or their natural history, for they have enriched mankind's mental and spiritual life as well as his material welfare. Not only has civilization developed against a background of trees, but extending over millions of years through misty geologic eras, a major part of plant and animal life also evolved against a forest background. To find the first forest it is necessary to delve far back into the story of evolution.

The first trees

More than 300 million years ago there grew upon the featureless land the first trees of which we have any record. Of these earliest trees one of the largest and most impressive so far discovered in fossil form is one which must have thrust its branches to a height of 20 feet on the shores of prehistoric lake or lagoon near the present town of Naples, New York. And from the British Isles, evidence of even taller forests almost as ancient (lower Carboniferous) comes down to us in the form of an incomplete tree trunk more than 50 feet long and five feet thick at its lower end.

For millions of years, the forests slowly developed; and before the beginning of the Cenozoic era, or age of mammals, approximately 60 million years ago, more than nine-tenths of the plants were of kinds known today. The giant sequoias of California were in the ascendancy; and the ancient ferns, cycads and conifers made way for the modern maples, birches, oaks, walnuts, tulip trees and other flowering plants.

The Ice Age, during which most of England and northern Europe was buried, left the landscape sparsely dotted with Arctic willow and birch. Then with the return of a milder climate, primitive man of the earlier Stone Age or Paleolithic era was a witness of the return of pines and hazel; and his successor of the latter Stone Age, Neolithic man, saw mixed forests of oak, elm, lime and spruce-fir. Similarly in America, forests returned to the land that had lain under the ice. And as this natural reforestation took place the utility and the spiritual value of trees in the life of mankind began. For

if the value of trees were only esthetic, one can understand how the loveliness of forest light and shadow, and the mystery that seems to lurk there, must have affected primitive man. The saga of trees includes religious veneration in many races; solemn and serene, the forests were early churches, believed to be the abode of gods and associated in early mythologies with various deities. The Snoqualmie Forest in Washington, for instance, is called by the Indian name of "Sdoh-kwah-bluh" meaning "Moon-people." Even today Indians hold tribal dances in Washington's forests.

In these dense forests of the Pacific Northwest, heads grow dizzy searching for sky. Perhaps the heaviest stands of timber in the world are to be found in the West Coast States; they contain the great commercial remnant of softwood remaining in the entire United States, the greatest bodies of virgin forests yet uncut. These forests, together with such new growth as will develop throughout the country under forest protection, must supply the largest part of our timber needs for the next century.

How long will it last?

"The present yearly drain of saw timber in the Douglas fir region, for all uses and including losses from fire and disease, is estimated by the U. S. Forest Service at 7 billion feet, log scale. At this rate the present 546 billion feet of standing timber might be assumed to last 78 years. This figure has no practical significance, however. The actual supply of raw material is affected by the species, quality and accessibility of uncut timber and by the degree of utilization that becomes economical from time to time. . . .

"Furthermore, new timber growth is a factor of importance—both at present and in the possibilities of future forest management.

"It is not unreasonable to anticipate ultimately a sufficient degree of Douglas fir forestry and fire prevention that will permit the region to sustain a yearly cut of timber products in excess of 15 billion board feet annually, or double the total present forest drain of sawtimber in the Douglas fir region.

"To translate this potentially into cold fact, with all that it portends to the economic advancement and stability of the region, requires effort and co-operation by the private timber owners, the state and federal agencies and the public of the Pacific Northwest."*

Whatever estimate is placed upon their perpetu-

* "West Coast Lumber Facts" (1937); West Coast Lumbermen's Ass'n. Courtesy of Col. W. B. Greeley—formerly Chief of the U. S. Forest Service, now Manager, West Coast Lumbermen's Ass'n.

ation, the importance of Douglas fir in the national forest panorama is unequivocal.

Rich in her share of these myriads of western trees, the State of Washington regally wears the lumber crown of the United States.

"Timber!"

The woodsman shrills his warning as 200-foot giants crash to earth. Whining of saws and the cutting swish of axes make an endless "paean of the woods" in Washington. The Brobdignagian "toothpicks" pile up, ranking the lumber industry second only to agriculture as a source of revenue in the state.

In this Evergreen State you will find thousands of hills buried in trees, hundreds of mountains skirted with forests, whole primeval forests, rooted in centuries. Wandering endlessly among trees, at the brink of a green chasm, you can touch their resin-sweet bark at arm's length, while your eyes roam downward over tiers of pinnacles to where a river flows far below. All the land, apparently, has turned to trees.

Fortunately, some of these forests will be preserved for posterity. The total net area of the national forests in the State of Washington is 9,579,187 acres, more than ten times as great as Germany's Black Forest, famous in fable and story. Most of these gigantic forests are crested with mountain fastnesses, including glaciers, peaks (some inaccessible and among the highest in the country), lakes and rivers. The recreational asset of these national forests is incalculable.

The king of trees

East of the Cascades are open park-like forests, where the wind forever blows back the smell of sun-baked pines. Down the lower slopes of these Cascade Mountains and westward to the Pacific Ocean, stand the long-legged Douglas fir forests (*Pseudotsuga taxifolia*) where the monotony of billions of dark purple tree trunks is relieved by growths of hemlock and spruce, and the moist forest air is heavy-laden with fragrance of cedar.

The acknowledged king of western trees is the Douglas fir.

Early explorers saw Washington firs that still are standing, for it is not uncommon to find these tree-patriarchs 700 years of age. The "never-ending" firs immortalize the name of David Douglas, famous Scottish naturalist, who visited the Columbia River District in 1825, as field representative for the Royal Horticultural Society.

But, as might be expected in a commercialized world, part of these great forests are turning to gold. It is in the coastal plains of Washington and

Oregon that the Douglas fir reaches its best development, and under normal conditions approximately 200,000 acres of it are logged annually in these two states, where more than half the virgin stand is comprised of these trees. Nowhere else is there a soft-wood stand of such immensity. The whole world looks to this region for this wood.

Reaching high for sunlight, a straight, regularly tapering stem often branchless for 100 feet or more, is characteristic of the Douglas fir. Rich, moist soil, heavy rainfall, favorable temperatures, and lack of severe winds in this section favor the growth of firs. Silvicultural conditions are among the most favorable in the world. Natural seeding usually ensures a crop (Douglas fir seed retains its viability for at least eight years when stored in the forest floor), fire protection is generally well organized, and any cut-over tracts unsuitable or not needed for agriculture are already under systematic reforestation.

The harvest of Douglas firs is of corresponding largeness; and a complete list of the uses of this versatile wood is nearly a complete list of wood uses.

Today ships from every corner of the world load Douglas fir in Washington and Oregon ports. Indeed, the Douglas fir section of western Washington and Oregon now produces one-third of the nation's lumber supply.

The lumber industry of Oregon and Washington is of first importance to labor. The industry normally employs from 72,000 to 80,000 workers and pays out over \$120,000,000 in yearly wages. It carries 55% of the total industrial payroll of the two states. Logging camp and sawmill employees in this Douglas fir region are the highest paid lumber workers in the world. Almost half the total cost of a 1000 feet of West Coast lumber is in wages.

Throughout the entire nation, forest industries support eight and one-half million people, the states of the south now producing the bulk of the lumber and providing most of the employment, while the industry in the states of the West—Oregon, Wash-

ington, Idaho and California—pays the highest wages. The West Coast production now comes second, with the West Coast a major factor in national lumbering only for the last 30 years.

Of the 12,912 mills reported by the government in 1929, last census, but 1380 were located in Oregon and Washington (most of them comparatively large mills, however), leaving 11,535 lumber making units in twenty or more different states.

But all the green-gold wealth of trees—and all their beauty—is at the mercy of the forest's greatest enemy—fire. For although "one tree can make a million matches; one match can destroy a million trees."

Between 1926 and 1930 the average annual burn in the United States* was such that reforestation of the burned areas would take, at the rate we are doing it now, approximately 135 years. (This is assuming that all the burning was wholly destructive.)

In addition, each year 985 million cubic feet of timber are destroyed by disease, insects, drought, wind, operations for deriving naval stores, etc. And uncontrolled grazing by domestic animals is making forest reproduction impossible in some localities.

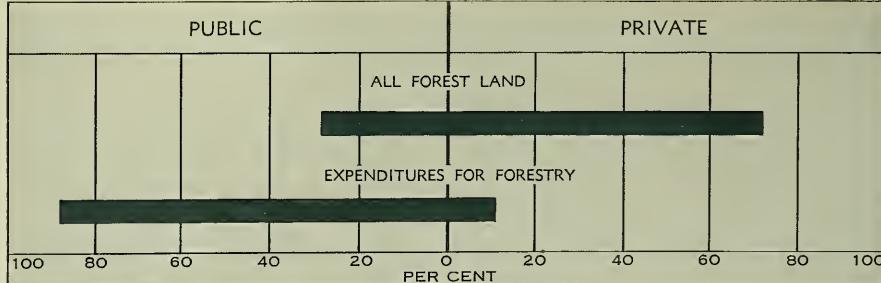
With four-fifths of the most valuable or commercial forests under private ownership, all but 5% of public lands are receiving adequate protection from fire, while 55% of all private lands are protected. Forest fires burn each year forty-odd million privately owned acres and less than one-half million publicly owned acres.† Fortunately, only a comparatively small portion of this area is productive forest land.

A constantly decreasing proportion of these fires is due to negligent logging methods; a great majority being the result of our careless American code of "out-door morals" and disregard of private property

*41,538,000 acres, totaling 156,183 fires and destroying nearly 900 million cubic feet of timber. American Tree Ass'n. Forestry Primer. (1787-1937 Sesqui-Centennial Data.)

†Report (1937) of Chief Forester of the United States, F. A. Silcox.

Courtesy Earle H. Clapp, U. S. Forestry Service





Asahel Curtis

(Left) DOWN TO THE SEA IN SHIPS went huge logs of Douglas fir from the old Port Blakely Mill in Washington to the world's markets. Every country needs wood, for, next to food, the forests' green gold is man's greatest necessity. Yet America's green gold is running thin. Three hundred years ago nearly half her land area teemed with forests; today only one-fourth can produce commercially



THE SHEER BEAUTY of living trees has always satisfied many of man's esthetic and spiritual needs just as wood has aided him materially. Civilization itself developed against a background of trees. Thus in countless ancient cultures the religio-artistic as well as economic life was based on trees. And even so recent a figure as Theodore Roosevelt declared that, "American democracy was born of no theorist's dream . . . it came out of the American forest." To this day, in magnificent Pacific coast forests, Indians still hold their age-old tribal dances as if to remind us that the case for forest conservation does not rest on economic grounds alone



(Right) BEFORE MASS PRODUCTION methods began to take their devastating toll of Pacific coast woods, pioneer lumberjacks cut timber with oxen power. The early American lumber baron's philosophy of "cut out and get out" is traced not only to ignorance and greed but to the psychological effect on colonists and immigrants of the New World's seemingly limitless tree wealth. Our forebears, largely banned from Europe's aristocratically restricted forests, wantonly released their repressions on this rich wilderness

(Photo by Asahel Curtis)

A 664-YEAR-OLD KING of western trees—the Douglas fir. These firs logged in Washington and Oregon alone produce one-third the nation's wood supply. Rapid extension of the present cooperation between national and private administration of these forests is of vital importance to everyone; for the liquidation of all this and even more green gold within 78 years is theoretically possible at the present rate of consumption



Photo by Asahel Curtis

ONE TREE CAN MAKE A MILLION MATCHES but one match can destroy a million trees. Fire is the forest's greatest enemy. The tremendous annual "burn" of American timber is attributable partly to our careless code of "out-door morals" and partly to the negligent logging methods of some lumber companies. But both causes have a common root—the general apathy of the American public as a whole toward conservation. Present trends toward a militant conservatism must be encouraged and can be if all will realize that the future standard of American living is directly dependent on present advances in forest conservation



WHEN THE CIRCULAR SAW operated by a water wheel began to replace the vertical saw about 1820, the death knell of many forested acres was sounded. But lumbering methods have been so speeded up today that each year we are cutting over an area equal to Massachusetts and New Jersey combined. This fact has still graver implications for every citizen when the rôle of forests in flood control and erosion prevention is considered

Reproduced from American Forests Magazine by courtesy U. S. Forest Service and The American Forestry Association



(Left) SKY-STREETS OF WASHINGTON where forest trails lead to the mountains. Here tourists may wander endlessly through the towering beauties of our few remaining virgin forests

(Above right) TOO BIG FOR A SAW MILL, these 70-foot Douglas fir logs will remain uncut. Such enormous logs are usually put to work as "dredge spuds" that keep dredges in a fixed position. The simple fact that Nature needs centuries to grow these logs should make the irresponsible lumberman pause

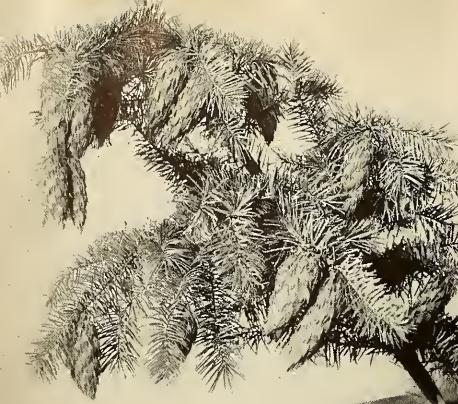
All photos by
Asahel Curtis

(Right) LIKE THE TROUBLE-SHOOTERS of the telephone company, these spureeled, arboreal steeple-jacks scramble aloft and saw or chop down the tops of trees, which are then lowered via cable attachment by a donkey engine below. Tree-top sections thus secured are used largely as ships' masts

(Below right) LOG RAFT: timber flowing down stream to the mills. It is a notorious fact that America's waterways are daily carrying her precious topsoil out to sea. Will America also allow them to float away her green gold without installing an adequate reforestation program to compensate for the staggering annual consumption?

(Left) FOREST GHOSTS: an example of the negligent logging technique that was until recently one of the chief causes of forest fires. The picture at left was taken in the Douglas fir region where one-sixth the annual cut is abandoned during logging operations. In this region, however, most of such wastage is unavoidable under present market conditions. Happily, due to conservationist effort, logging waste in the south and east is now negligible





(Above) NATURE'S GIFT TO THE CONSERVATIONIST: seed-bearing cones of the Douglas fir. Seedlings are set out in nurseries where they are watered and cultivated during the first two to five years. The urgent need for such far-sighted activities was admitted by few privately owned companies before the last decade



(Below) THE CONES MUST BE DRIED in these trays before the seeds can be extracted and planted. The increasing appropriations, private as well as federal, for reforestation are a sure sign that our era of "man-made" forests is dawning



(Right) THE FORESTS OF THE FUTURE trickle through this man's fingers as easily as coffee beans and in each of those tin cans behind him 1000 acres of tall timber lie packed. Our forests of the future will be counted on to provide raw material for such increasingly popular chemical derivatives as cellophane, rayon, artificial leather, etc.





(Left) FOREST YOUTH: the future of our lumber resources. Groves like this can and should be planted over large areas. Tangible results of forest planting have recently enlisted the increasing coöperation of many private companies who have abandoned the technique of "timber mining" (treating wood as non-replenishable), for timber cropping



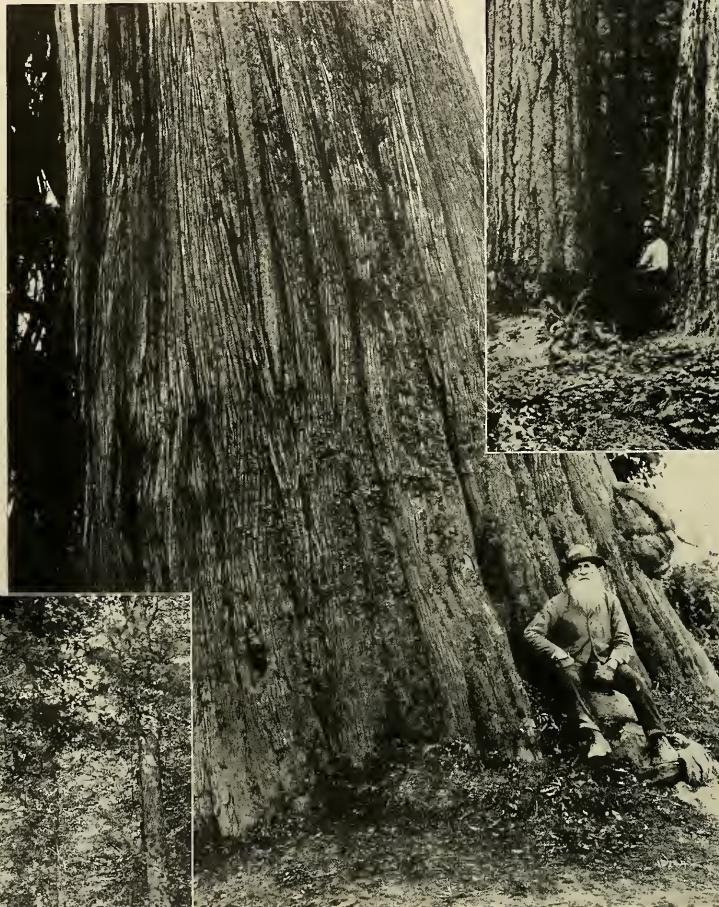
(Above) FOREST BABIES, asking for some space in the forest world. The planting of forests is not just a beautiful gesture to our great-grandchildren. If someone proposed deeding away one-sixth of the United States to a foreign power, wouldn't you object? Yet, practically the same loss will be suffered if we allow our woodlands to lapse into non-productive idleness

(Below) AT EIGHTEEN the young forest begins to take shape. Thrusting its limbs upward for life-giving sunlight, it promises some day to achieve the magnificent stature of the vast, mature, sweep of woodland shown at center of page

Asahel Curtis



MANY GENERATIONS will pass before "man-made" trees will achieve the size and grandeur of the Douglas fir shown at right. Yet when you consider that the Sunday edition of one New York newspaper requires 80 acres of trees and that from 1925-29 America's total drain on soft timber was five times greater than its growth, the need for the tree troopers who march across the continent with mattocks in one hand and baby trees in the other, becomes exceedingly clear



Photos by
Asahel Curtis

(Above) Two WESTERN PATRIARCHS: a 70-year-old graybeard and a 700-year-old cedar. Upholders of pioneer initiative who shy away from reforestation as something "new fangled" are referred to the Chinese and the freedom-loving ancient Greeks, both of whom operated reforestation departments about 2000 years ago

(Left) JUDICIOUS FORESTRY protects these beeches and sugar maples of the Monongahela National Forest in West Virginia. Unless reforestation is pressed far beyond its present encouraging range, idle land and consequent slower production of wealth will result. Not only will our green gold be squandered but the worker, producer and consumer will suffer alike the brunt of a higher cost of living. Forest Conservation spells sustained yields in health and recreation as well as the stabilization of near future industry and employment

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The American Forestry Association





FOREST REGIONS of NORTH AMERICA

NATIONAL HISTORICAL
MAGAZINE

AFTER
HENRY S. GRAVES

NORTHERN FOREST. Characteristic Trees: (Northern portion). White, red and pink pines, spruce (taiga), poplar and aspens, birches, tamarack. (Southern portion). Hemlock, beech, birches, ashes, aspens, chestnut, white, red, and scrub pines, spruces, fir (balsam), hemlocks, tamarack, arborvitae.

PACIFIC COAST FOREST. Characteristic Trees: Douglas fir, spruces, larches, western red cedar (arbutus), hemlocks, redwood and big-leaf, yellow and white pines, incense, Port Orford, and yellow cedars, fir (balsam), junipers, yew, cypresswoods, maple, alders, birches, madrona, laurel.

CENTRAL FOREST. Characteristic Trees: White, black, and red oaks, hickories, chestnut, walnut and hickory, yellow poplar, cherry, ashes, elms, maples, beech, locust, linden, buck eyes, cottonwood.

ROCKY MOUNTAIN FOREST. Characteristic Trees: Yellow pines, Douglas fir, fir (taiga), spruces, junipers, pinon pines, aspens, cottonwoods, oaks.

SOUTHERN FOREST. Characteristic Trees: Yellow pines, white, live, red, and black oaks, hickories, cypresses, white cedar, juniper,

red and tupelo gums, magnolias, bay, elms, hollies, ashes, cedar orange.

PLAINS, DESERT OR TUNDRA. Regions devoid of any kind of forest owing to aridity, low temperature or other climatic causes.

TROPICAL FOREST. Characteristic Trees: Southern Florida and Southwestern Texas are the only portions of the United States in the Tropical Zone. Besides a number of smaller species, the following trees are characteristic of the Tropical Region of Southern Florida: Royal palm, Jamaica dogwood, manchurian, mahogany, mangrove.



rights. There is very urgent need for personal awareness of responsibility on the part of the recreation-seeking public, in preventing fire hazards. Most of the fires are the result of the "age-old land use" struggle between grazing and forestry—fires set deliberately by farmers and cattlemen.

Indicative of the growing coordination between the lumber interests and government agencies was the National Conservation Conference held at Washington, D. C., in April, 1937. Here the National Lumber Manufacturers Association and affiliated groups representing every lumber district in the United States and all phases of private ownership production and distribution, together with representatives of government departments, formulated well-planned methods for a continuous and sustained forestry program which included among its primary objectives: the maintaining at a minimum loss from fire, insects, wind-kill or uneconomic utilization.

But fire-proofing the forests and forest pathology are only aspects of Conservation. Thirty years ago, President Theodore Roosevelt said, "The conservation of our natural resources and their proper use constitute the fundamental problem which underlies almost every problem of our national life."

Without condoning mistakes which undoubtedly have been made in the past, it must be acknowledged that federal foresight has instigated the first ambitious measures to preserve our heritage of forests, while private owners, interested first in the immediate return, have generally in the past neglected Conservation.

But "a near-revolutionary change in owner attitude toward forest management has occurred within the past decade, sustained yield forestry coming in the private field as rapidly as economic conditions permit. It is being preceded by adoption of more conservative logging practices, and closer attention to the necessity of protecting reforesting lands from fire."*

Important in flood control

This is gratifying, since it is impossible to over-emphasize the importance of far-sighted planning for an adequate forest reserve. Each year we are cutting over an area equal to Massachusetts and New Jersey combined, and since our forests are a distinct feature of our national background, what is done to them affects the economic and recreational resources of every person. Demanding particular attention at present, is the rôle that forests play in flood control and prevention of erosion, though this cannot be discussed here.

*John B. Woods, Secretary, Conference Committee, National Forest Conservation Conference (1937).

Under a concerted nation-wide attempt employing scientific forestry, the peril to our forests and the lumber industry will be alleviated.

Of course, the person who is tree-conscious inclines to the principle that all of a tree should be utilized, except perhaps "the knotholes and the whispering among the branches." Admittedly, that is not always practical, but it is a fact that our forests of the future will no longer be considered primarily producers of logs, lumber and cordwood. The modernized version of forest wealth includes a long list of special products—pitch, resin, tar, turpentine, cork, rubber, sugar, nuts, fruits and seeds—and a rather amazing list of chemically derived products, such as paper, rayon, cellophane, artificial leather, roofing felts, and conduit pipes.

Pulpwood

A single phase of lumbering—the pulp-paper output—demonstrates the importance of some of the present-day side issues of the industry. The Sunday edition of one New York newspaper requires the wood from 80 acres of trees. Eighty-five per cent of all paper is made of pulpwood; and already the United States uses more paper than all the rest of the world. Estimates of our probable pulpwood requirements by 1950 range from double to triple the present quantity, about half of which is now being imported from Canada and Europe.

It is obvious that the present rapid national expansion of the pulpwood industry, involving huge investments, would not be warranted by private capital unless timbermen believed that there would be adequate future forest resources for this purpose.

Recent statements from the Forest Service, for example, show that on January 1, 1934 the growing stock of pine in the southern states was 15,215,409,000 cubic feet, and the growth that year was 891,350,000 cubic feet. This was not sufficient to meet the drain for forest products and that caused by fire, disease, etc. However, under forest management which would accompany intensive use of these pine forests for lumber and pulpwood, the annual increment or growth would be increased to over 3,000,000,000 cubic feet. This would be enough wood to supply 300 pulp and paper mills of the size of those now being built in Jacksonville, Florida, and other southern centers. In fact, there are now operating and in course of construction some thirty mills in that area which would use only some 10% of the possible increase in wood production.

In the Pacific Northwest, even during the worst "depression years," pulp mills were running full capacity to supply the astonishingly increasing de-

mand for rayon, cellophane and other wood-pulp products.

Happily for the future of such forest industries, as well as for beauty and recreation, the protective measures which in the past few years have attracted more and more consideration are not too late to be effective.

Already, crowding the stumplands of America, come new copes of trees, slender as spears—a younger generation proving that forests are no longer considered irreplaceable, but a growing crop. Seedlings are set out in nurseries, and up push the miniature trees. They are watered and cultivated during their first two to five years, depending upon variety and health, until the little pindling youngsters are ready to take their proper place in the forest world. Then with a mattock in one hand, a baby-tree in the other, the tree troopers go across the land, leaving a new forest behind them.

Approximately 215 million trees were planted by the U. S. Forest Service during 1936. This topped the previous all-time high mark in 1935 by more than 60%. Field crews planted at the rate of one-half to one acre per man per day. Tree nursery production had to be geared high to meet a demand approaching a quarter of a billion trees in one year. A single nursery produced over 57 million trees. During 1937, the plantings covered 153,405 acres and the trees totaled 145,530,000, of which all except 2,769,000 trees were various varieties of pine.

Only a start

But compared with our forest needs, reforestation has been progressing at snail's pace. According to the Copeland Forestry Report (1933), the area that must be considered for planting in the United States included 138 million acres.

While artificial reforestation has lately progressed to an amazing extent, it is doubtful that man will ever compare with Nature in reproducing extensive crops of mature trees. The major source of new forest growth must come from natural reproduction encouraged by protection and silvicultural cutting.

With both Nature and man cooperating, the rehabilitation and conservative utilization of our forests is assured.

Needless to say, such a sequel is welcome; especially since during the past half-century forestry has become a highly controversial subject.

Some advocates of government control contend that "almost every one of the forty-eight states is headed toward forest bankruptcy in timber of merchantable size."** And, adopting the premise that

private forestry is hopeless, they advance the plea that only a public acquisition of forest lands can make possible a wise and long-range plan for conservation.

On the other hand, some proponents of private ownership claim that there is little in the record of either the Forest Service or the Congress to indicate that the Federal Government is equal to the task of solving our forest problem by outright regulatory legislation. They further assert, it is not a fact that private forestry has failed, or that it can succeed only through federal regulation. They maintain that the most serious defect in public cooperation for research and forest protection is the failure of State Legislatures and the Congress to supply adequate funds. That private ownership and industry would welcome federal efforts to do first things first, beginning with adequate cooperation in forest protection, research and diligent attempt toward needed reforms in forest taxation. And that public acquisition of forest lands is not a sound solution of the forest problem.

Hope in cooperation

Actually—making allowances for the extreme views—there exists a very forthright and increasingly practical cooperation between the government and the private interests, in behalf of perpetual forestry.

"During the past five years private forestry cooperation has increased in leaps and bounds, mostly in the field of fire protection and in the adoption of better woods practices. For instance, the Southern section of the American Pulpwood Association has adopted cutting rules which they require to be observed by all farmers from whom they purchase pulpwood. In California, some of the largest lumber companies have entered cooperative agreements for fire protection. Private forest cooperation is intangible—it can't be tied down to figures—but we know it is increasing steadily.*

Lack of judicious forestry means idle land and consequent slower production of wealth. And not only is our green-gold forest wasted, the worker, the consumer, and the community are harmed. Forest conservation means sustained yields in health, recreation, work, stabilization of industry and employment, and high living standards. So the present portentous trend in forestry concerns itself with human values.

The application of modern principles of forestry is an integral phase of our economic era—one of

**"Forest Bankruptcy in America: Each State's Own Story," G. F. Ahern (1934).

*C. E. Randall, Acting Chief, Division of Information and Education, Forest Service, U. S. Dept. of Agriculture.

Continued on page 393

SUN-SPOTS IN THE NEWS—*Nearing the peak of the sun-spot cycle we may well ask how climate, crops, health and even the stock market may be affected by these huge, electrical "whirlwinds," several times as large as the earth itself*

By WM. H. BARTON, JR.

Executive Curator, Astronomy and the Hayden Planetarium, American Museum

SUN-SPOTS are in the news! These curious markings on the solar disk have been appearing more frequently and in greater numbers since the latter half of 1933. We have been climbing the curve of the sun-spot cycle—and now we are nearing the top. Within the next year the peak will probably come and then for the following five or six years the spottiness of Old Sol will diminish. In the low of these periodic swings, days will pass without a blemish appearing. At the present time a few spots are always in view—and occasionally there is one large enough that you might notice without using a telescope. During the past half year several such naked-eye groups were recorded. They are somewhat rare, but long before the telescope was turned on the sky such markings were known.

Back in those distant times it would have been impious to believe that "the eye of the world" could suffer from ophthalmia. These tiny black dots were mistaken for small planets circling around the sun, and appearing like birds against the moon. They were even named by their discoverers.

These solar blemishes still form one of the major mysteries of astronomy. In a cryptic cycle they come and go with a semblance of regularity. Through

WILLIAM H. BARTON, JR., is a familiar personality to visitors of the Hayden Planetarium where he has served as lecturer and Associate or Executive Curator since 1935, having previously been connected in a similar capacity with the Fels Planetarium in Philadelphia. Professor Barton is trained both as a civil engineer and an astronomer, and the two phases of his scientific career are expressed in the titles of his two books, *Sampling and*

Testing of Highway Materials (with L. H. Doane) and *A Guide to the Constellations* (with S. G. Barton). The first volume resulted from his engineering experience in teaching and practice. During this period and later, he indulged an interest in astronomy by taking graduate courses in that subject at the University of Pennsylvania, where he had also received his civil engineering degree. His work on the 1932 Franklin Institute Eclipse Ex-

pedition marked the beginning of an intensely active astronomical period, which has continued to the present through his work with the Hayden Planetarium and as a member of the American Museum Peruvian Eclipse Expedition. Professor Barton has lectured at a number of institutions and is a frequent contributor to magazines and newspapers. His new book *Starcraft* will be published by McGraw-Hill this spring. —THE EDITOR.

same time much learned about the nature of the sun-spots themselves.

They are cyclones in the solar atmosphere, something like the ones twisting around a "low" on the weather map—multiplied a few million times. They are highly magnetic, and send out into space a bombardment of electrical particles. While we cannot predict where nor when an individual spot will appear, we do know that they seldom or never form on the sun's equator, nor in the polar regions. Spottiness is confined to two belts, one north and the other south, between solar latitudes 5° and 40°. They come in cycles of about eleven years, but this period has been as short as eight years and as long as sixteen.

The spots of a "new" cycle generally appear in the middle latitudes while those of a disappearing group will be near the equatorial edge of the spot belts. Succeeding spots of the incoming group appear lower and lower during the life of the cycle. These solar whirlwinds are really great cavities in the sun's outer layers. But what is the explanation of all these facts, and of many others that might be cited? Unfortunately that cannot be directly answered. A Norwegian meteorologist named Bjerke has a rather elaborate theory of the circulation of the sun's atmosphere that accounts for many of the well known phenomena. He cannot write a complete and convincing story of why the atmosphere behaves as it does, nor why it does so in an 11-year period.

Many think that some outside influences affect the sun, perhaps some tidal influence of the planets. The planet Jupiter, the greatest of all the earth's neighbors goes around the sun in 11.8 years. The spot cycle is, on the average, 11.2 years but the half year is too great a difference to laugh off. Professor Brown, of Yale, tried to work a combination of planets into the problem, but that, too, failed. Perhaps the future will bring some more satisfactory solution to this cosmic puzzle.

Effect on climate

Then the practical man asks, "But what have these spots to do with us? Are they important?"

Yes, they are. A great many tie-ups are being made between sun-spots and terrestrial affairs. For instance, Professor Douglass, at the University of Arizona, made a very complete study of tree rings. His keen eyes discovered that the rings on the Arizona pines and the big redwoods were not uniform, but that generally a year of unusual growth was followed by ten or twelve of only average development. This patient scientist had examined thousands of specimens with the hope of finding the "pattern" of drought and rainfall. And here was written the

sun-spot curve. Then the sun-spots were connected to weather and the growth of living things.

From studies made by Dr. Charles G. Abbot, Secretary of the Smithsonian Institution, we learn that the temperature and rainfall of a locality swoops over a 23-year cycle—and in an even more marked way, through a 46-year period. These are multiples of the sun-spot cycle of about $11\frac{1}{2}$ years. It is probable that our own Middle West that has been suffering from drought will take a turn for the better when the sun-spot cycle changes this year or next.

In explaining these weather effects we find that as the sun-spots appear on the sun both the amount and character of the sunlight is altered. The proportion of ultra-violet radiation from the sun is increased during the years near a sun-spot maximum.

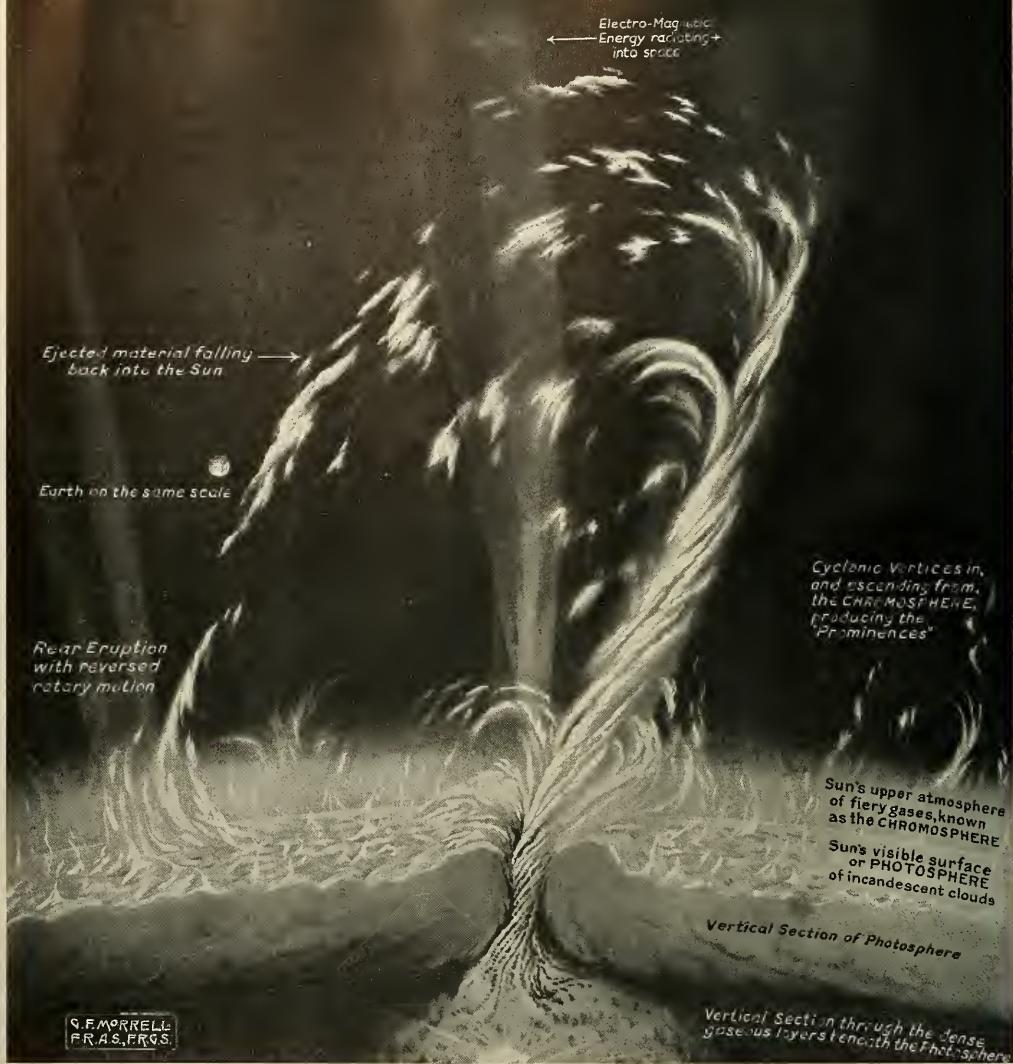
Not only may this ultra-violet light affect the weather but it may affect many other terrestrial affairs. Just what the result of this radiation is we cannot say. Dr. Harlan T. Stetson of Massachusetts Institute of Technology, is inclined to believe that this change in radiation may affect our emotional response. In fact he correlates the spot cycle with the growth of animals, with the economic situation, with social movements, and may in his pioneer work be laying the foundation of a new evaluation of astronomy.

Sun-spots and history

In an article in *THE SKY**, Doctor Stetson says, "Some time ago Professor Tchijevsky, a student of sun-spots and world happenings, astonished the American Meteorological Association with certain deductions which he had made from comparing years of sun-spots with years of social agitations and uprisings throughout history. He seemed to convince himself that most of the cycles of social agitations concurred remarkably well with cycles in sun-spots. Certainly the industrial agitation that has been going on in the early part of 1937 is not inconsistent with this Russian scientist's hypothesis, for we have just been having a most remarkable increase in sun-spots for two decades. In fact, not since August, 1917, have such violent outbursts been seen on the surface of the sun as we have witnessed this year. Incidentally, it was during the peak of sun-spots in 1917 that the Russian Revolution set in."

"If there is any connection between sun-spots and human affairs, one would at least like to know what basis, if any, there is for a possible mechanism by which changes in the sun may be expected to produce changes in our behavior patterns. Unfor-

* "Sun-Spots and Human Affairs," Harlan T. Stetson, *THE SKY*, November, 1937.



Cross Section of a Sun-spot: A "Whirlwind" of Solar Fire

COURTESY OF GEORGE F. MORRELL, F.R.A.S., AND THE ILLUSTRATED LONDON NEWS

THE STUPENDOUS VORTICES OF FIRE which are seen from the earth as sun-spots originate at unknown depths far below the sun's photosphere. The photosphere, which is the visible surface of the sun, consists of dense, incandescent clouds of heavy metallic vapors at yellowish-white heat and surface temperature of about 6000° C. When a sun-spot occurs, streams of fiery elements burst through this layer with a swirling rotary motion given them by the sun's rotation, and a vast outpouring of radiant and electro-magnetic energy is projected into space. Lighter elements soar spir-

ally upward with terrific force, involving fiery hydrogen, helium and calcium vapors in the Chromosphere. The illustration shows such a scene (above the Chromosphere) that was photographically recorded through the spectro-heliograph as a "prominence" at the sun's edge. The elements sped upward some 325,000 miles in 50 minutes, an average of about 6500 miles a minute, equivalent to traveling from New York to Chicago in seven seconds. Note the enormous size of the disturbance as compared with the earth shown to scale



Keystone View Co.

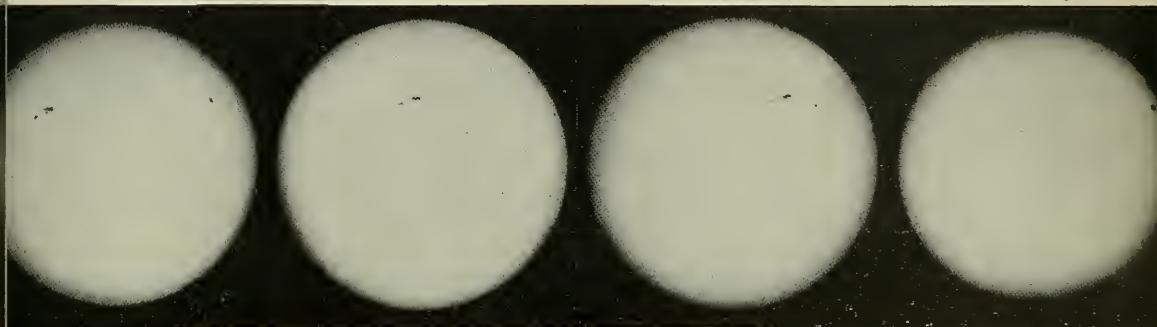
Do Fire Storms on the Sun Cause Dust Storms on Earth?

A DEFINITE RELATION has been observed between the number of sun-spots at a given period and weather conditions. It is even likely that our drought-ridden Middle West will take a turn for the better when the sun-spot cycle passes its peak this year or the next. The effect does not result from an increase of heat sent to earth during sun-spot maximum but presumably from an increase of electro-magnetic energy and ultra-violet radiation. The latter may also affect us not only physically, by contributing more vitamin D to our

bodies, but psychologically through changes in our endocrine glands.

In different localities rainfall and the thickness of tree rings have been discovered to change in a cycle corresponding to the sun-spot cycle of approximately 11.2 years, or multiples of it (23 and 46 years). *Below:* Movement of sun-spots across the sun's surface shown by photographs taken at approximately 2-day intervals

Photos by I. M. Levitt at Cook Observatory



HORROR AND BEAUTY

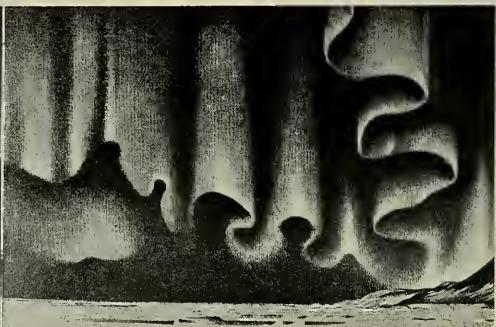
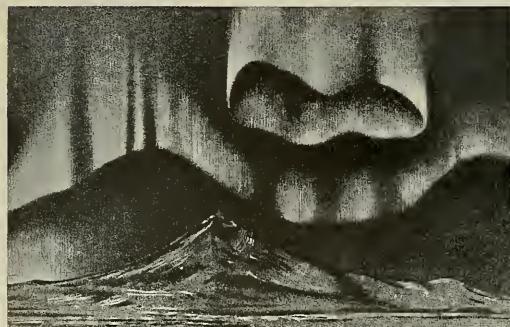
DROUGHT AND NORTHERN
LIGHTS: two possible effects of
abundant sun-spots

SUN-SPOTS photographed at Mt. Wilson Observatory. During the past half year several groups were visible to the naked eye using only smoked glass



A SPOT that is visible to the unaided eye would be at least 50,000 miles in diameter and might appreciably aggravate conditions in the Dust Bowl or enhance the beauty of the northern lights. Above is shown the desolation wrought by drifting sands in Oklahoma, believed to be caused in part

by abundant sun-spots. (*Below*) Auroral displays recorded by the National Antarctic Expedition of the Royal Society: a spectacle of transcendent splendor known to be caused by electro-magnetic waves sent out by the sun in greater volume at times of maximum sun-spots



tunately, satisfactory scientific data in regard to this is meager, yet there are two possible lines of reasoning which may have some basis. One of these concerns changes in the quality of sunlight as it may affect us and the atmosphere we breathe. The other concerns the result of the varying quality of sunshine upon the food we grow and eat which may thus indirectly affect us.

"Everyone knows the importance of ultra-violet radiation. The boom in the sale of health lamps is testimony to this. There is, of course, both health and danger from these life-giving rays. Ultra-violet light produces vitamin D in all of us, and unquestionably increases our resistance to disease. Too much ultra-violet, however, can produce detrimental effects. Biologists have shown that ultra-violet radiation has marked effects on certain glands in the human body, and now medical science shows that our mental attitude is largely measured by the secretion of our endocrines. Some day we may learn to regulate our emotions by exposing ourselves for the proper length of time to prescribed radiations.

Approaching a maximum

"Now sunshine is very rich in ultra-violet light. Fortunately the earth's atmosphere has a blanket of ozone which screens out most of the harmful light from the sun, and lets just enough through for our health and well-being if we take advantage of what sunshine Nature provides. But would you know? The ultra-violet light from the sun varies from day to day and year to year. Actual measurements have shown that in general the ultra-violet light from the sun is much more potent during years when sun-spots are most numerous and less potent during years when sun-spots are scarce. It is this stimulating effect of ultra-violet radiation which, through the years of increasing sun-spots, revitalizes us, increases our energy, and, when too strong, results in agitation. However, this may be, we are approaching and are now very near a period of unusual numbers of sun-spots.

"The last sun-spot maximum occurred in 1928 and 1929 when things were booming. There was one big uprush of sun-spots in November and December of that year. Then came the crash of the sun-spot market. The chart of the numbers of sun-spots fell down precipitously, finally reaching the bottom at the end of 1933. If Major Angas, Colonel Ayres, Roger Babson or other noted investment counselors had predicted the boom of 1929 and the depression of '32 and '33 on the basis of sun-spots, they could not have done better. And if Wall Street had predicted the rise in Dow-Jones Averages from the middle of

1934 to January, 1937, on the basis of a chart of sun-spots, they would have won hands down. In addition to this main trend of sun-spots, there are secondary fluctuations just as there are in the market. Since February, sun-spots have been going down constantly for about four months, but they will come back again. Probably we shall have them recovering to a new high before another year is over. I'll make no further statements market-wise.

"If we look back over previous years, we do not often find the correspondence between sun-spot numbers and business activity so pronounced. There is, however, a rather definite indication that four out of the last five major depressions have followed within two or three years after the maximum in the numbers of sun-spots. If the market is an index of psychology on the part of investors and, one's moods of optimism and depression change with changes in the characteristics and the radiation of the sun which followed the sun-spots, then we would be led to believe that the affairs of mankind are much more intimately related to our cosmic surroundings than science has thus far been led to suppose."

These strong electrical currents from sun-spots have another marked effect on the earth's atmosphere. The earth is a magnet and when these streams of electrons bombard us they are attracted toward the poles.

Northern lights explained

Here, when they come in contact with the rarefied gases of the upper atmosphere a glow is produced. This light is not unlike the colored discharge in the Neon tube advertising sign. Just as different colored signs can be made by using tubes of different gases so these lights are variously colored. And that is the true explanation of the northern lights or aurora borealis. Similar displays around the southern pole of the earth are southern lights, or aurora australis. Together they form the polar lights. When there are sun-spots in abundance the lights shine with greater frequency and enhanced beauty.

The records of such displays run back to Aristotle, Cicero and Pliny. The common explanation of this striking phenomena was that the armies of the sky were fighting. They imagined they could hear trumpets and the clashing of arms along with the lights. Strange as it may seem, even today there is some doubt about sounds with the aurora. A crackling noise is often said to accompany the lights. One explanation is that the noise is the breath freezing, or ice cracking underfoot. This could happen only in very cold regions, and sometimes auroras are seen much farther south. A very common explanation of northern lights attributes them to sunshine reflected

from tiny ice crystals high up in the atmosphere.

During the past few months fine displays have been reported from Europe, especially England. Even as far south as Bermuda unusual northern lights were reported. With sun-spot activity still increasing, beautiful aurora displays may be looked for. Even in and near New York City they have been seen within the past year and no doubt will be again. Like sun-spots they do not come on schedule but there are certain favorable times. There is more chance of seeing them before midnight than after. Some old studies show August and September to be rather more likely months than later in the winter. There is a prevailing superstition that they can be seen only during the winter. Perhaps this is because in the Arctic region where the displays are most beautiful the summer months are light and preclude any possibility of seeing them.

Variety of forms

The lights may assume a number of forms. A very common variety looks like a long arch of light across the sky. This generally centers somewhere near the north point of the horizon and may stretch nearly to the east and west points. The arch generally is white, but may tend toward the yellow or green in tone. The edges are either definite or shade off gradually.

A very different form may resemble a searchlight beam, or perhaps a number of beams appearing to radiate from a point below the horizon. These pillars of light may flicker upwards toward the zenith in an undulatory manner, or may swing toward either the east or the west. Reds and greens sometimes brighten up these streamer displays.

A still more beautiful type is the curtain. In this a 3-dimensional illusion is the most striking feature. Spun from the nothingness of space these draperies

form before the eyes and seem to decorate some vast heavenly proscenium. Sometimes they hang from the zenith and appear to be hanging low, so low, it seems, that one might touch them.

The writer witnessed a most varied display in Maine on the night of September 3rd last. The display began with a colorless arch about 5° wide stretching from just north of east to just north of west and standing about 45° over the north point. For an hour it remained almost unchanged, except for patches of luminous cloud fading in and out near the eastern end. Gradually the ends of the arch disappeared until it stood in the sky seemingly without support. Then the ends warped into folds, and from the top of the arch a sheet of light slowly mounted the sky until a curtain was formed. Then the color changed to bright apple-green. Within a half hour it faded completely. In its place, in fact over the sky from the north to half way down the southern sky a pale flickering covered the heavens. Swift waves of this light darted in every direction. It was impossible to discern a pattern, so vaguely and rapidly did the light run. And then it died out and all that remained was the usual bright horizon glow in the north.

Deserving of fame

Along with the aurora come disturbances to the magnetic compass, interference on the radio, and trouble for the telegraph and cable companies.

Yes, sun-spots are in the news and rightfully so. Sun-spot study is no mere academic study. Not only do they produce the most beautiful of all celestial phenomena, but they may alter our moods, bring stock market crashes, remake the dust bowl, key us up to war frenzy, or change the price of pelts.

Yes, sun-spots are in the news, and they deserve their notoriety.



A RARE PHOTOGRAPH of the amber fishers recovering the harvest of a storm on the Baltic Coast (*Staatliche Bernstein—Manufaktur*)

THE STORY OF AMBER

By WILLY LEY

Known to the ancient Greeks and denounced by Pliny as demoralizing, this sea gold of the Baltic gave man his first ideas of electricity and assists modern science with preserved specimens of prehistoric plant and animal life

IT was during my very first visit to East Prussia—I was not quite fourteen years old at that time—that I became acquainted with the Gold of the Baltic under circumstances that recall the elemental scenes of *Pierre Loti* or more recently the *Man of Aran*.

We had driven to Cranz, a sea-beach resort on the Samland coast not far from Königsberg, the capital of East Prussia and, incidentally, the city of Immanuel Kant. We did not start out on this trip until late and it was raining so heavily that it took hours to drive the short distance of about 30 miles. When we arrived it was pitch dark; there was a heavy storm raging over the Baltic. Although it was mid-summer the air felt chilly and we had neither a reason nor did we feel like going to the beach, from which the thundering noise of surf could be heard for miles. But we were up early the next morning on a planned hike along the shore. Although the storm had

subsided somewhat during the night the sea was still rough and the surf fairly heavy.

To my great surprise I saw people working busily near the shore line. Men with hip boots and heavy clothing were wading in the water carrying nets built after the pattern of butterfly nets but much larger and with handles ten or even twenty feet long. They thrust these nets into each wave that rolled up to them, and when the net was filled after a while with something that looked dark and dirty they waded back to the shore and threw their "harvest" on the sand. Women and children were busy pulling the tangle of seaweed—such was the main content of the nets—apart and looking carefully for pieces of a yellow material that could be frequently seen in the weed. Occasionally these yellow pieces were thrown into the nets apart from seaweed. The women and children not only scrutinized the seaweed brought to shore by their hus-

bands, fathers and brothers but also searched bunches of seaweed thrown up on the beach by the waves directly.

Naturally I asked what these fishermen were doing and was informed that they looked for amber. I was told that there must be a large quantity of it on the sea bottom, because after stormy nights some was always washed up to the shore by the waves, either in independent pieces or entangled in seaweed.

It was quite a number of years later that I learned the complete story. Samland's coast, rising so abruptly from the Baltic, usually with only a very narrow beach, consists of comparatively young marl and sand. Starting from the top in a typical locality—say Palmnicken on the West coast—one encounters first a superficial layer of sand of glacial origin, about ten or twenty feet thick. Then come layers of lignite with light sands and clay, of later Tertiary origin, mainly from the Miocene. A fairly thick layer of so-called green sands from the early Tertiary comes next; and underneath these one finally finds the true amber layer: the "blue earth." I cannot tell why this completely black sticky hard material that has about the consistency of clay should be

spots at the bottom of the Baltic. Amber is very nearly buoyant, having a specific weight of 1.07 while sea water weighs around 1.025. In quiet water it sinks to the bottom, but disturbed water will carry it along.

Blue earth strata touch the present day shore line in several places. One of them is close to the small village of Palmnicken where the Prussian state operates the only amber mine on earth. The mining engineers in this mine duplicate with machinery what Nature has done for thousands of years with the force of water. Large, scientifically designed steam shovels dig the diluvial and Tertiary sands away till the blue earth is exposed. After being scooped up with machines in large quantities it is then brought to the "wash rooms" where jets of water separate the blue earth from the vast amounts of amber that are imbedded in it. With contrivances similar to large sieves or strainers and by other methods the raw amber is retrieved from the muddy soup. After drying it is transported to Königsberg where it is mechanically cleaned and assorted by hand.

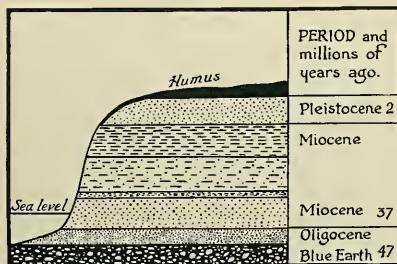
Large and clear pieces, constituting about 20% of the total production, are used for the manufacturing of fine ornamental objects with which we are familiar. The other pieces, that are of dark and unattractive color or that contain many impurities, are brought to a chemical factory. Here they are heated to about 300° C. At that temperature decomposition takes place, amber oil and amber acid (succinic acid) being distilled from the dirty boiling liquid. A black residue, amber pitch, which is left, is later treated with oil of turpentine or linseed oil to result in "amber varnish."

From the moment of washing the blue earth special watch is kept for pieces with "inclusions"—insects, flowers, etc., trapped and preserved in the hardening resin in prehistoric times. These are always much in demand, not only as scientific specimens but for jewelry.

Up to about 1880 small pieces of good clear amber and the chips and dust resulting from the manufacturing processes had to go to the refinery for distilling. Then a method was discovered of melting amber under pressure to make these small pieces flow together. The result, called "ambroid," is used especially for mouthpieces of pipes and cigarette holders.

It was in 1264 that amber was mentioned for the first time in an official document. The order of the German Knights transferred the right to fish and to dig for amber north of Pillau to the Bishop of the Samland—proof that the amber deposits even then had considerable commercial importance.

But amber was known in Europe long before that



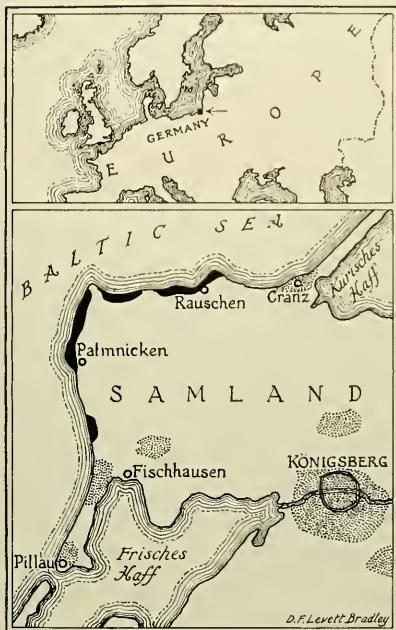
Geological profile showing amber-bearing blue earth near Palmnicken

termed "blue" earth. If it has any color at all—aside from black—it is a dark greenish hue.

It is this "blue earth" of the lower Oligocene, dating from some forty or fifty million years ago that contains practically all amber. Occasionally it can be found in other strata from the same geological time, but these finds are few and far between. As soon as a layer of blue earth is touched, amber is found in abundance. The amber washed ashore by the waves is believed to come likewise from blue earth layers lying exposed to the action of the water in certain

time, in fact since before the dawn of recorded history. Amber beads are common in prehistoric burials of the Bronze Age in Great Britain; and near Schwarzort in East Prussia amulets of amber were found in tombs even from the Stone Age. Pieces of amber were also brought to light when Schliemann excavated the tombs at the ancient city of Mycenae in Greece, representing an almost mythological period.

In early literature amber is mentioned three times



The vast deposits of amber, which have yielded more than a million pounds in a single year, are located on the Samland coast of the Baltic Sea in East Prussia. In the lower map the black areas are Oligocene layers with amber-bearing blue earth; the dotted areas are Oligocene but without blue earth

in Homer's *Odyssey*; but there is some uncertainty, because the Greek word *electron*, from which "electricity" is derived, not only meant amber but also an alloy of gold and silver. It seems likely that of the three instances, one refers to the alloy while the other two to amber. A similar linguistic riddle pre-

vails about three references in the book of Ezekiel to something sparkling, which some authorities interpret as meaning amber, though there is not definite proof. It is also possible that one of the famous twelve stones in the breast-plate of the High Priest was amber.

Thales of Miletus, the Greek philosopher and astronomer (640-546 B. C.), seems to be the first to discover electricity in observing that amber, when rubbed with a cloth, attracts short pieces of straw or similar matter. It is from this property that amber received one of its early names, *karabe*, "that which attracts straw." Then there was the Arab term *anbar*, which originally meant ambergris but later amber, the other valuable product of the seas. The word found its way into English probably by way of the Spanish which absorbed so many Arab words.

But in the world of letters the story of amber really begins with that rather choleric old Roman colonel who became known as Pliny the Elder (A. D. 23-79) whose book of Natural History is a tremendously comprehensive work of ancient knowledge. True to character, he scolded amber as a luxury, as he scolded any other luxury from asparagus to dyed hair:

Next in rank among the objects of luxury we have amber, an article which for the present, however, is in request with women only . . . luxury has not been able as yet to devise any justification for the use of it. This is a subject which affords us an excellent opportunity of exposing some of the frivolities and falsehoods of the Greeks.

Pliny's anger and scorn were directed especially against the assertion of some Greek authors that amber was nothing but hardened lynx urine. Others believed that it represented a peculiar kind of sea-slime, hardened by some cosmic influence and washed upon the shore by the waves. The word *electron*, though its derivation is not perfectly known, is usually brought into relation with *elector*, meaning sun-glare; and in more poetically inclined minds amber was supposed to be sun-foam, sun-glare that became solid when it struck the sea.

But Pliny also related in a trustworthy manner the knowledge of his time about this material that is both common and unique, and he had a good conception of its true nature.

There can be no doubt that amber is a product of the islands of the Northern Ocean, and that it is the substance called by the Germans *glasum*. [It is to be noted that this is the word from which our "glass" is derived.] . . . Amber is produced from a marrow discharged by trees belonging to the pine genus, like gum from the cherry, and resin from the ordinary pine. It is a liquid at first, which issues forth in considerable quantities, and is gradually



(Above) THE AMBER MINE near Palmnicken on the Baltic coast of East Prussia where the greatest known amber deposits lie. Here the valuable fossil resin of ancient trees

is excavated from the famous blue earth in which it was deposited some forty or fifty million years ago

(Photos from *Staatliche Bernstein-Manufaktur*)



(Above) BUCKETS on an endless belt scoop up the blue earth, which has produced over a million pounds of amber here in a single year

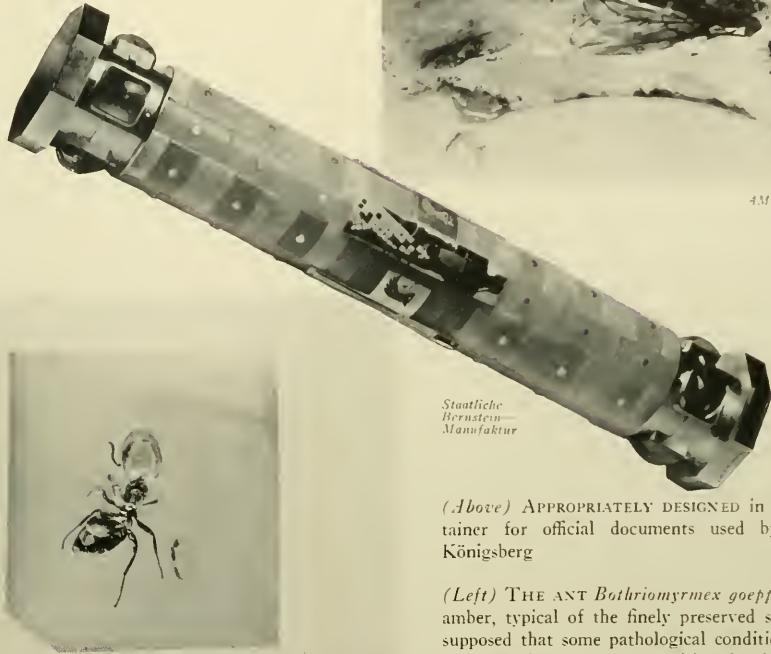
(Below) JETS OF WATER separate the blue earth from the vast amounts of amber embedded in it. Strainers retrieve the amber from the muddy soup



(Right) AN INSECT caught in the prehistoric flow of resin and preserved: a caddis fly, from the American Museum's collection of amber inclusions. From insects thus imprisoned and bits of fossil vegetation an amazingly complete picture of the original amber forest is reconstructed. A dozen or more species of trees and innumerable insects have been identified, including the only fossil flea known to science, *Palaeopsylla klebsiana*



AMNH Photo by Coles



(Above) APPROPRIATELY DESIGNED in amber: a container for official documents used by the city of Königsberg

(Left) THE ANT *Bothriomyrmex goepperti* trapped in amber, typical of the finely preserved specimens. It is supposed that some pathological condition of the trees produced the enormous quantities of resin which formed amber

AMNH Photos by Coles

(Below) A SPECIMEN OF COPAL, one of the many types of fossil resin which are not true amber, fairly riddled with insects caught in the congealing mass



(Below) A WELL-PRESERVED ANT (*Paraneuretus sp?*) Seventy thousand specimens of fossil inclusions in amber are contained in a single collection in Germany

hardened by heat or cold, or else by the action of the sea, when the rise of the tides carries off the fragments from the shores of these islands. At all events, it is thrown up on the coasts in so light and volatile a form that in the shallows it has all the appearance of hanging suspended in the water. Our forefathers, too, were of the opinion that it is the sap of a tree and for this reason gave it the name of *succinum* (sap-stone); and one great proof that it is a tree of the pine genus is the fact that it emits a pine-like smell when rubbed and that it burns, when ignited, with the odor and appearance of torch-pine wood.

However, Pliny could not go on for long without some remark about the low morals of his time:

So highly valued is this as an object of luxury that a very diminutive human effigy made of amber has been known to sell at a higher price even than living men, in stout and vigorous health. . . .

The worst, in Pliny's opinion, was the "new" shade of hair dyeing, "amber-color," probably inspired by the blond hair of Germanic girls that were brought to Rome with the amber of their country. The beloved wife of Nero (37-68) had hair called *succinum* (amber) by her illustrious poetically-minded, imperial husband.

The riddle of its source

The source of amber in ancient times presents an interesting problem involving early European trade routes. The river Eridanus is mentioned in legend and history as the source, but there was controversy regarding its identity as far back as Herodotus, the "father of history," in the 5th century. It was identified as the Padus (Po) and as the Rhone; and one historian has even ventured the conclusion that "the very name Eridanus still lingers in the name of the Radaune, west of Danzig." Danzig is near the amber country, to be sure, but to classify the tiny Radaune, which might not have existed at all in classical times, as Eridanus, is certainly no small error.

If some actual river has to be assigned to the Eridanus, it might best be the Elbe, as suggested by Prof. Richard Hennig. Hennig believed that the first amber to arrive in the classical world did not come from the Baltic but from the North Sea and that the much larger Baltic deposits did not become known to Greece and to Rome until around 100 B. C. If it was North Sea amber, the Elbe would be the logical river to transport the valuable material southward.

When the new and much larger amber deposits near the Baltic became known to the Mediterranean nations, the amber trade experienced a boom. Julius, the nobleman responsible for Emperor Nero's

gladiatorial shows sent a Roman knight to the amber country. He traveled first to Carnuntum, east of Vienna, then a famous base of the Roman Danube fleet. From here the Roman knight stated that another 600 Roman miles "as the crow flies" were necessary to take him to the amber country, and this distance would just about have taken him to the promontory of Samland, the most abundant known site. At any event he returned with several thousand pounds of amber. The nets that protected the imperial *podium* or parapet in the arena against the wild beasts were "studded" with it, meaning presumably that amber studs were inserted in the knots. Furthermore, all the weapons and implements of the gladiators were decorated with amber, and the display was changed every day. The largest piece of amber brought back by this knight weighed 13 pounds, which does not exceed our largest museum pieces.

With Pliny and Tacitus the first chapter of the story of amber found its glorious climax and its end.

The reappearance of amber in history was closely connected with the Order of the German Knights after they had taken what is now East and West Prussia and Danzig under their jurisdiction. The Order put its mailed fist on amber: nobody thenceforth had a right to possess any unless authorized by the Grand-Marshal himself. Strict laws were enforced by even stricter measures; there were tales of rows of gallows on the beach even centuries later. Much of the amber found—property of the Order, of course, was sent to Bruges, where a special guild of amber turners had established itself. They called themselves "paternostermakers," makers of rosaries, and numbered 70 masters and 300 helpers and apprentices in 1420.

Later the princes of Prussia took over the seigniorial privilege, and the fishermen were obliged to turn over the amber they found to certain "receivers" for the same weight in salt. The privilege was sublet and re-sublet several times until at long last the Prussian state established itself as amber merchant and later opened the amber mine and issued the laws that are valid to this day. All East Prussian amber, the laws read, is property of the Department of Internal Revenue which issues permits to fish or to dig for it under condition that all that is found be turned over to the government against pay. All amber found elsewhere in Germany is subject to the same law if found on the seashore but belongs to the finder if found somewhere inland.

Up to about 1800 the scientific knowledge of amber did not develop any further. On the contrary, the theory of Georg Bauer, called Agricola, abandoned the classic resin explanation and substituted

the bitumen theory. Writing Latin, he is also responsible for the term *lapis ardens* as a re-translation of "burning stone." Bauer's ideas were colossal errors and barred scientific progress for centuries.

Only about a hundred years ago scientists began to ponder the problem anew, no longer handicapped by lack of geographical knowledge like the ancients and assisted by some first groping conceptions concerning past ages of the earth's history. The classic resin-theory was revived with many a good proof, and a little later a chemical analysis was made, showing that amber answered to the formula $C_{10}H_{16}O$, which is very similar to the formula for camphor, $C_{10}H_{18}O$. A high percentage of succinic acid (between 3 and 8%) was found in Baltic amber; hence the name "succinite" proposed by Prof. J. D. Dana and now commonly used in scientific writings. Varieties differing slightly from succinite are found in Rumania, Sicily, and Burma. A number of other types of fossil resin from widely separated parts of the world are often termed amber and contain very little or no succinic acid. These are evidently fossilized gums from other trees, but as a means for classification many have received family names derived from the people connected with the history of amber—Beckerite, Gedanite, Stantienite, etc. In keeping with the term succinite for amber, the tree from which it came was named *Pinites succinifer*, in translation: "the amber-producing, pine-like tree." It seemed obvious that the tree that produced the wealth was a relative of the pine tree, but nothing was really known about it.

In their efforts to learn the natural history of amber, scientists centered their attention shortly before 1850 on the fossils found in the blue earth. But because certain small deposits of brown coal were supposed to be contemporaneous with the amber but were not, a profound error arose which is worthy of mention because it persisted in popular books up to about the time of the World War.

It was mistakenly supposed that the primeval amber forest must have been a swampy forest, because of the brown coal deposits which were close to and sometimes actually above the blue earth deposits. These led scientists to think of the amber forest in terms of the cypress swamps of North America and of the Everglades of Florida. The amber forest was imagined to resemble the immense swamps of the Carboniferous age in which most of the coal of the world was formed. Thriving presumably during the Oligocene period, the forest was believed to have "bled" golden amber when lightning broke the trees or storms devastated the swamp. Near the sea, these tracts like the Everglades could have been invaded by sand, driven either by storm or tidal wave, which

could have separated the blue earth containing the amber from the brown coal deposits which later were formed when the forest perished and fell. The brown coal on the Samland is in places no more than about three feet above the blue earth, a distance which in the days when geologists believed in sudden, catastrophic changes did not seem too great.

Carried by water

The theory was nice and sounded plausible, but it was proved wrong when the facts were examined more critically. It was found that these coal deposits had nothing to do with the blue earth layer at all. They were a product of a much later time, belonging to the Miocene period, still within the boundaries of the Tertiary age but anywhere from 100,000 to 500,000 years more recent. On the other hand, practically no traces whatever could be found of the trees which really produced the amber. The explanation of this is that the amber must have been moved from its original location, by currents of water. In other words, the deposits of amber we know are not primary but secondary deposits.

The fossils found in the blue earth likewise refuted the swamp theory and supported the theory just mentioned. They are all fossils of creatures of a salty sea. There were remains of sea urchins (*Laevipatagus bigibbus*), teeth of the shark *Carcarodon obliquus*, fossilized oyster shells (of the variety *Ostrea ventilabrum*), and specimens of the crab *Coeloma balticum*. From these fossils scientists had to conclude that the blue earth had been formed at the bottom of a sea and in moderate depths because there were oysters. The fact that among these remains of salt water life there should be quantities of amber so vast as to overshadow everything else, presented a difficult riddle until it was realized that the amber was an older product which did not belong with the blue earth although it occurred in it. Perhaps the amber had been washed down from the forest to the sea by rivers, perhaps the sea had encroached upon the land.

The story is, therefore, as follows. The amber forest grew at the beginning of Tertiary times somewhere in northern Europe, where primary deposits were laid down. Later, in the Oligocene period, rivers cut their way through them or the sea, moving inland, washed them away. The amber was carried by currents of the primeval ocean to quiet, shallow spots where it could settle to form the secondary deposits we know. Real primary deposits of amber are not known. Possibly those pieces that are washed up by the waves come from primary deposits, but it is unlikely. In all probability the sea gold given up

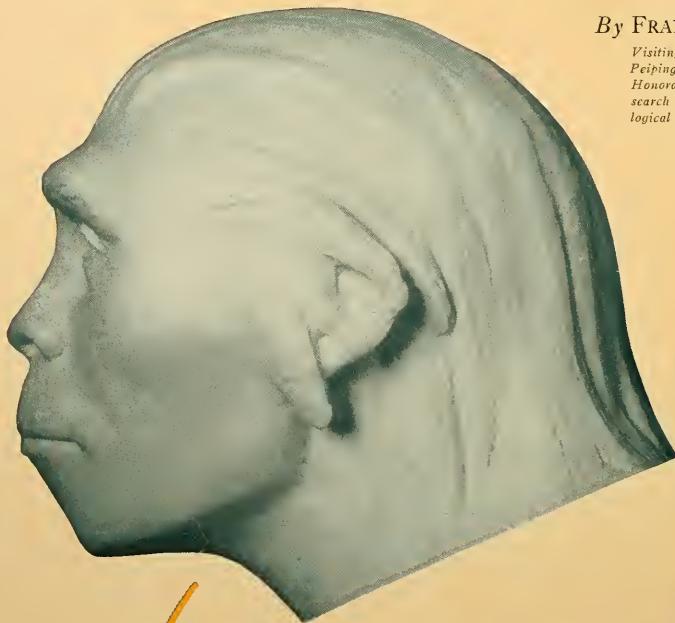
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THE FACE OF PEKING WOMAN

Latest developments regarding our celebrated ape-like relative

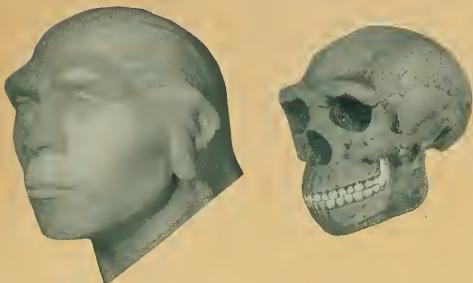
By FRANZ WEIDENREICH

Visiting Professor of Anatomy,
Peiping Union Medical College;
Honorary Director, Cenozoic Re-
search Laboratory, National Geo-
logical Survey of China



CRETACEOUS

FURTHER DISCOVERIES relating to Peking Man (*Sinanthropus pekinensis*), whose existence in China some hundreds of thousands of years ago was discussed in the September, 1937, NATURAL HISTORY, have made possible the reconstruction of the entire face as shown above. A large fragment of the upper jaw was the important new piece which, added to the abundant material already discovered in more than ten years of digging, completed the picture of this extremely ancient relative. The reconstruction may be considered a genuine standard female type of mature age. Since practically all bones of the skull were available, with the exception of the zygomatic arch, the restoration was made merely by adapting the size of the single parts derived from several individuals of different sexes from the same location. The life-like reconstruction was carried out with the kind assistance of the sculptor, Mrs. Lucile Swan.

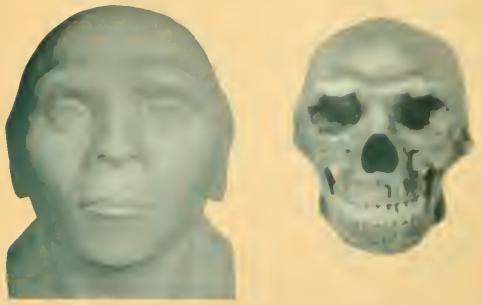


THE FEATURES AND HAIR were modelled directly on a plaster cast of the skull, the thickness of the soft parts being determined from measurements made on female heads of different present-day races recorded by various authors. The abundance of the remains and the great antiquity of the Peking Woman make this collection of human fossils the richest and most complete ever recorded, unique in every respect. The work has been made possible through the generous support of The Rockefeller Foundation

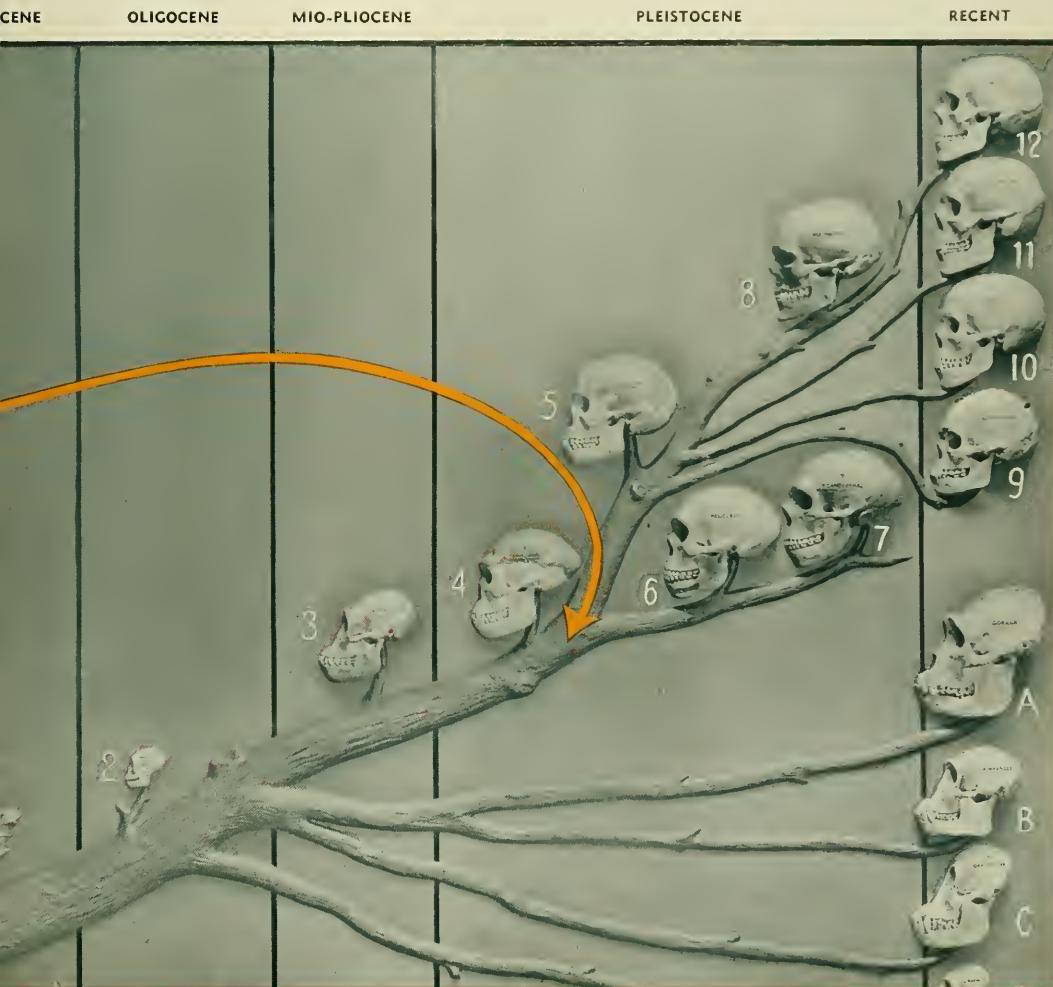


(Below) MAN'S FAMILY TREE, showing approximate position of the Peking Woman. Note that the nearest relatives above the Peking Woman are distinctly higher in the evolutionary scale. On the other hand Peking Woman is definitely well above any creature which gave rise to any of the modern apes or monkeys. The only human skull which conceivably occupies a lower position in the scale is *Pithecanthropus erectus* (4), from Java.

The other skulls represented in this chart, which was constructed by Dr. William K. Gregory of the American Museum on a careful weighing of various lines of evidence, are as follows: 1. Primitive Primate (*Notharctus osborni*), 2. Prototypal anthropoid, 3. Primitive anthropoid, 4. Trinil Ape Man, 5. Piltdown Man, 6. Heidelberg Man, 7. Neanderthal Man, 8. Cro-Magnon Man, 9. Australian black-fellow (one of the most primitive of existing human races), 10. Hottentot, 11. Chinese, 12. American. A. Gorilla, B. Chimpanzee, C. Orang-utan, D. Gibbon



SINCE THE SKULL as a whole, despite its primitiveness in certain details, comes closer to that of recent man than to any of the great apes, the external features were modelled to conform more or less to those of recent man



Skull of Peking Woman compared with gorilla and modern Chinese

AMONG THE VERY PRIMITIVE CHARACTERISTICS of Peking Man are the absence of chin, shape of the teeth and the size of the orbital ridges. The brain-case is elongated, very low, and a transverse section of the skull is arched as in the apes, instead of being

oval as in the Neanderthaloid or modern man. By such characteristics *Sinanthropus* represents one of the lowest anatomical stages so far discovered in human ancestry

FEMALE GORILLA
ADULT



PEKING WOMAN
ADULT



MALE NORTH CHINESE
ADULT



A ROUND TRIP TO DAVY JONES' LOCKER—*A loop of swordfish line around the ankle is something that every fisherman dreads. Here is the story of a man who went down with the fish but came back to tell the tale*

By WILLIAM H. HAND JR.
Naval Architect
New Bedford, Massachusetts

AUGUST 4, 1935, gave promise and later proved to be a fine day for swordfishing—clear, calm and hot. We nosed out of the harbor of Menemsha, Massachusetts, before sunrise in the motor-sailor *Buckaroo* and headed for the fishing ground. By 9 a.m., we were about 25 miles south of Noman's Land. Mastheaders were aloft and everyone was on the lookout.

Presently a large fish was sighted and I went forward to the "pulpit." When I was put onto the fish I harpooned it in conventional fashion alongside the dorsal fin, and the keg was thrown overboard after the line had run out. A little later, Murray Pratt, a giant of a man, was dropped off in the dory to "haul" the fish.

Man overboard

We cruised on, looking for more fish, and when about half a mile away, one of the mastheaders called out, "Better put your glasses on the dory—things don't look right there."

The glasses showed the dory bottom up and no man in sight. A small sloop about a hundred yards away was making for the overturned boat. Sensing that something serious was wrong, we turned and made full speed towards the dory.

On arriving we saw two men in a skiff that had put off from the sloop, supporting the limp body of Pratt, who appeared drowned. The dory was bottom up and a short distance away was the swordfish threshing about on the surface with the dart sunk in its body and the harpoon line dragging in the water. The sloop was the *Helen*, Captain Ed Gardner, of Menemsha. She was alongside the skiff when we got there, and Pratt was hauled on board her. Fortunately for Pratt, my friend Dr. F. E. Stetson of South Dartmouth had accompanied me on this trip. He and Herbert Flanders, one of my crew, hurried aboard the *Helen* and, aided by Cecil

Watson of sloop *Helen*, began a long siege of artificial respiration.

After about a half hour's hard work the man came to enough to emit the most unearthly groans, and at the end of an hour or more he became semi-conscious. Pratt was then transferred to *Buckaroo* and we started full speed for the U. S. Marine Hospital at Vineyard Haven about 50 miles away.

When hauled from the water Pratt had an open jackknife clutched in his right hand. Before we reached Vineyard Haven he recovered enough to tell his story about as follows:

Taken for a ride

"I hauled the fish up to the dory once but couldn't hold him. He ran off a ways and then seemed to come in easily enough until I had him alongside again. Next he started to the bottom and I couldn't hold him any more than if he had been a team of horses. Before I knew it, a turn of the line was around my ankle and over I went and down, down. I tried to kick the line off but it wouldn't come free, so, while I was heading for the bottom, I felt for my knife. I first hauled out by mistake a cigarette lighter from my left trousers' pocket. Then I went into the right pocket and got my knife. Somehow I got it open and managed to reach down and cut the line. Then I started to swim to the surface and that's the last I remember. How did I get here anyway?"

Pratt must have been down pretty deep since his ears bothered him for many days and he was terribly lame for quite a while after his involuntary dive. He had had nearly three years' service in the Canadian army in France and had been "gassed" several times. For this reason we feared pneumonia, but this fortunately did not develop and he was discharged from the hospital after three or four days. Today he is well and apparently as rugged as ever—and that is "some" rugged.

Pratt owes his trip to Davy Jones' locker to his disregard of a fixed rule of mine that those going

Continued on page 393



PHYSICAL BEAUTY is more conspicuous among the women of the Waropen coast in the north of New Guinea than elsewhere in the island. The inhabitants of this section have until recently lived a secluded life and are quite ignorant

of the civilization that is certain to descend upon them. Many wild customs are practiced by these natives, including primitive orgies, which missionaries and government agencies are endeavoring to control

Native Life in New Guinea

By NASH NEJAME

*All photographs by the author through Ameri's *Candid**

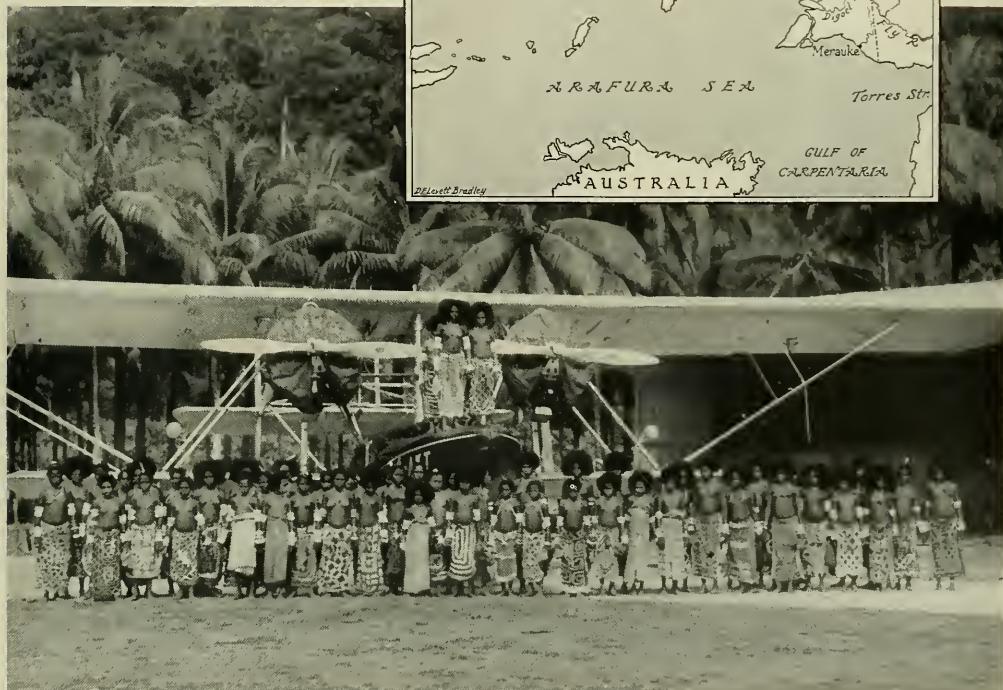
CANNIBAL TRIBES and snow-capped peaks just below the equator have always lent a peculiar fascination to the island of New Guinea, which embraces one of the largest unexplored areas on the face of the globe. The recent aerial survey carried out with the support of The Netherlands Government succeeded in mapping the enormous area of 30,000 square miles in the western part of the island.

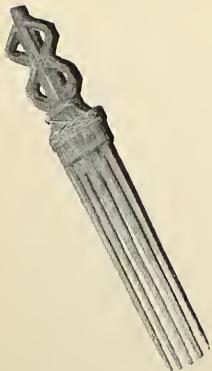
Discovered by the Portuguese and Spanish in the second quarter of the 16th century, the island remained for three centuries the object of only superficial exploration which produced no real knowledge except a general idea of its outline. After 1906 and chiefly as a result of the expeditions made by Captain H. Colijn, the present Prime Minister of The Netherlands, military and scientific ex-

peditions accomplished a general survey of the territory. But even in 1935 the great mountain ranges which comprised the unknown central section remained uncharted.

From aerial photographs, which were developed with difficulty on the spot, field geologists of the present expedition selected areas for more detailed study and traveled overland with as many as 40 Dyak carriers, remaining in the field for two to four months. During the 18 months which Mr. Nejame passed in the island he had opportunity to observe many tribes and to make a collection of native arts, examples of which are shown. In company with Doctor Colijn, the son of the Prime Minister, he had the pleasure of making the second flight ever made over the summit of Carstensztop, the highest mountain on the island.

The present expedition, the first to make an aerial survey, made numerous flights from four base camps selected strategically around the coast at Seroei, Babo, Etna Bay and Aika





BODY TATTOOING of distinctive design is a favorite adornment of the Waropen coast girls. The bushy headdress is customary with this tribe and is made by binding the hair in an erect bundle with the leaf of a palm for two or three days and then combing it out with the bamboo comb shown above. The cast of countenance is typical of the northwestern part of the island where Indonesian influence is more apparent, and is quite different from that found in many other parts of New Guinea



A PAPUAN GIRL of Noeboeai (Waropen coast) showing the back scars sustained in the primitive orgies in which these people love to indulge. The scars are proudly exhibited as indication of the ardor of her suitors

LIVELY ARGUMENTS occur in the market over the limited plant and animal products with which Nature has endowed New Guinea

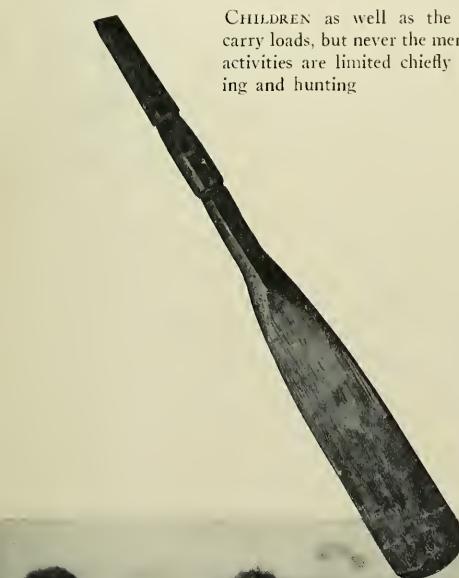




THE CHIEF FOOD OF THE NATIVES: a heavy load of sago wrapped in banana leaves, on its way from the wild palm tree to the native kitchen. Sago is found almost everywhere, and one trunk produces about 200 pounds



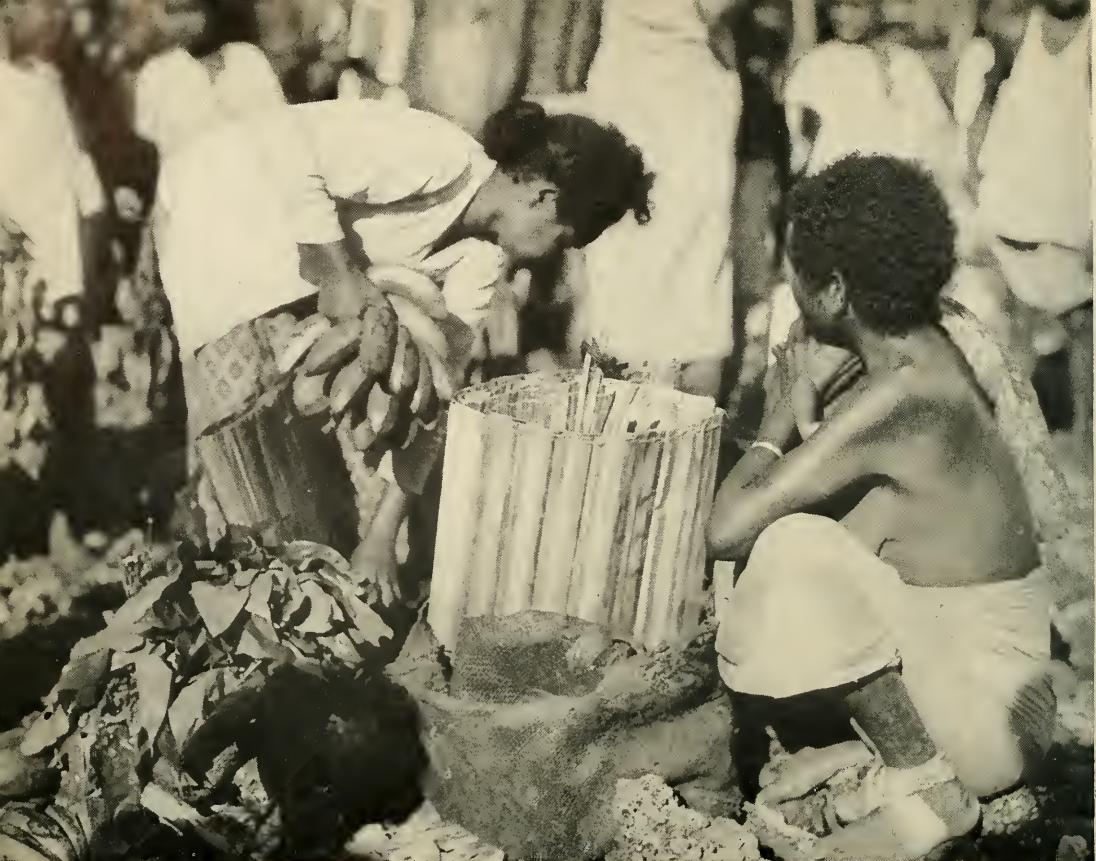
CHILDREN as well as the women carry loads, but never the men, whose activities are limited chiefly to fishing and hunting



THE SAGO is boiled for about four or five hours until it takes on a gluey consistency. Flavorless and so rubbery that it cannot be chewed, sago is swallowed whole, preferably mixed with dried fish or meat

PAPUANS EATING SAGO



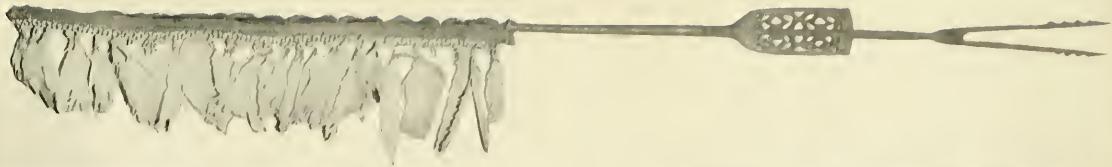


PAPUAN MARKET at Seroei on the island of Jappen. Aside from bananas, shown above, the chief crops planted and bartered by the Papuans are yam, taro, "batatas" (*Ipomoea batatas*). Small kangaroos are hunted for their flesh, also a wild pig which was probably introduced to the island by man, and other animals less appetizing. "One morning when I was strolling about the kampong," writes Mr. Nejame, "watching the women hard at work and the men lying idly about, there suddenly was a great commotion. Some creature had run out from under one of the huts and

everyone swarmed to the spot. With great rapidity they made a circle and gradually closed in, while their prey dashed frantically back and forth. From their eagerness you would have thought that they were capturing a great delicacy. By peering over their shoulders I discovered that their prey was a large rat. Rats and mice I later saw displayed as food in the market place. But for some reason the natives appeared embarrassed and always hustled them out of sight when I attempted to take a picture"



DANCERS in full regalia celebrating the marriage of Princess Juliana of The Netherlands. A primitive tribute to a royal event, in Seroei on the island of Jappen



(Above) A SPEAR from the south coast of New Guinea



THE HORNBILL (above) is hunted for food, as is the crown pigeon (*Goura coronata*) (upper right), whose plumage and crown are purple and its eye yellow with a red pupil



A COCKATOO of New Guinea. Parrots are numerous, some genera being peculiar to New Guinea, others common to Australia



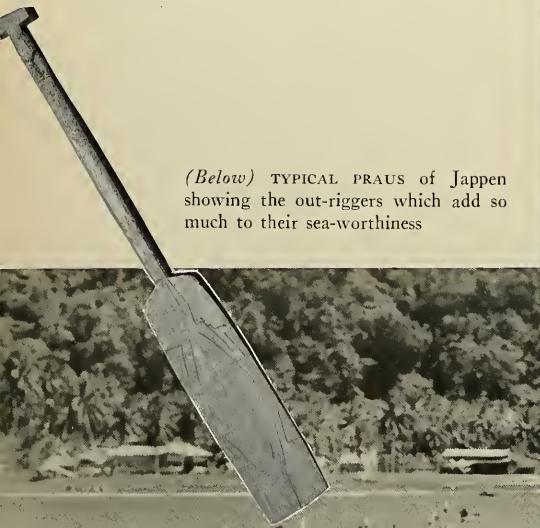


NECKLACES, beaded cloth "sarongs," shell bracelets and feather ornaments make the ceremony a gaudy celebration. Note the long, slender drums beaten by the men. The drumhead is of spotted lizard skin. In the center is seen an ornament of bird of paradise feathers



ONLOOKERS to the barbaric ceremony for their newly-married white princess many thousand miles away in The Netherlands. The girl at left has bound her hair in two bundles preparatory to combing it out to produce the bushy effect

RACES between native praus gaily decked out for the occasion were a feature of the elaborate native demonstration



(Below) TYPICAL PRAUS of Jappen showing the out-riggers which add so much to their sea-worthiness





THE ELABORATE OUT-RIGGERS, constructed without nails or metal tools, give the prau an awkward appearance but enable the natives to make long voyages in rough water



RATTAN WINDINGS about the waist are the most conspicuous garment of the Fafaiwa in the north of New Guinea



A TYPICAL WAROPEN GIRL from the coastal region of northern New Guinea

(Left) LONG NOSE SKEWERS are striking ornaments worn by the Fafaiwa. Note the vertical skewers projecting above the nostrils; also the curious headdress



(Above) AN ALBINO PAPUAN living on the island of Jappen, compared with a normal, black native



(Below) AN ALBINO PAPUAN WOMAN (Island of Jappen). Her daughter was likewise an albino



A NATIVE from the island of Jappen, just off the north-west coast of New Guinea



PAPUAN HOUSEBOAT: family life in a lagoon in MacCluer Gulf near the western end of the island. Lying on the deck are a wicker fish trap and a rolled up fish net. This type of net, which is made of bamboo strips resembles an old-fashioned porch screen, and is used in different parts of New Guinea in an ingenious way. "When a school of fish is discovered in water about five feet deep," writes Mr. Nejame, "the men quickly surround the area, sometimes in as many as six or eight boats. The net, which is rolled up like a strip of carpet and usually much longer than the one shown, is let down into the water. Working like lightning the men unroll the net and make a large circle of it, perhaps 40 feet across. When the two ends of the net are brought together one end is gradually worked around inside the other so that the circle becomes smaller and smaller. Finally the men have the net all rolled up on itself again with the fish inside, making a bundle as much as five feet in diameter, which is lifted aboard the prau and opened. The number of fish caught varies from a few to several hundred"

A SMALL MEMBER of the shark tribe speared in the large trap on whose pilings the native is standing. Note the bone prongs of the spear, a form used anciently by Stone Age man in various parts of the world. Shark fins may become an important export to China, where they are esteemed. Mackerel (particularly the bonito), sardines, and other fish are caught in considerable quantities. True, fresh-water fishes are almost entirely lacking



A CANNIBAL from the Flower River, southern New Guinea. Typical of the quick-tempered Manowe tribe, this native was angry over some trivial incident when his photograph was taken. "They are known to attack a passing canoe at the slightest provocation," writes Mr. Nejame, "this native holds in his hand a paddle that is also a spear. The feuds of the Manowe are so severe that it is feared the tribe may soon be wiped out. They fight to the death and the victor eats the body of his victim."

"I was told by a French missionary who had lived in the region 10 or 15 years that the old folk who have lost their usefulness are traded to a friendly tribe where they are eaten by people who are not their immediate relatives. "A month or two before my arrival an incident occurred among the Manowe Papuans which

shows their hostility. Eight government men were sent out to collect taxes from them. After collecting the taxes some of the men unwisely tried to flirt with the women. The natives waited until the men were asleep in their tents outside the kampong, then they attacked, killing them to the last man and feeding on their bodies. A search expedition later found only their bones and clothes.

"Never having lived under organized government these people have no conception of the purposes of taxes. All they really understand is that they get nothing in return. In return for a certain number of pigs, a Papuan receives a wife; in return for taxes, nothing. That taxes may be used to better their condition is something which these people will have to learn."





HOUSE DESIGN in New Guinea gives protection against tropical downpours yet provides abundant ventilation. This scene is in Etna Bay, in western New Guinea, a section where administrative problems have been better solved than elsewhere



CANNIBALS of the Flower River found the expedition plane an object of great interest; a scene in a district that is notoriously savage and difficult to administer. Note the typical vertical bands decorating the dugouts. These natives commonly wear no clothing at all, use the combination paddle and spear at all times

(Below) NEGROID FEATURES are more evident in this woman and child from Aika than in some of the natives shown earlier from Jappen in the north. The natives of The Netherlands New Guinea are classed as belonging to the black race rather than the brown which is found throughout many of the Polynesian islands. Considerable variation, however, is shown among them: some exhibit a considerable transition toward the Negrito, and pygmy tribes have been found in the interior. Skin diseases, as evident below, with which the natives are afflicted, are being treated by the missionaries and officials



IN HANDLING THEIR SLENDER DUGOUTS made from a single log, these natives display astonishing agility. They are expert swimmers but seldom use this ability except when fishing. Members of the expedition endeavoring to paddle these dugouts quickly capsized. "The skill of these natives in the water is surprising," asserts Mr. Nejame, "and we would be amused for hours at a time watching their acrobatics as they fished from the bow of a boat with their casting net. If the net became caught on a snag and failed to close properly, they would plunge in, swim under water, catch the fish in some way we could not see and come gliding to the surface with it in their hand, hurling the fish into the boat. They might make several trips like this and remain underwater an incredible time before the net was brought up"



WOMAN occupies a lowly position among the tribes of The Netherlands New Guinea. She does most of the work aside from occasional hunting and fishing. The man will cut down the sago tree, from which the natives derive most of their food, but it is the woman who carries home the heavy load, the man walking complacently beside her carrying nothing but his bow and arrow.



AUSTRALIAN FEATURES are seen in the curly hair and broad nose of this woman from Aika, Australia and New Guinea lie only about 100 miles apart at the closest point.

A TYPICAL PAPUAN CAMP, at Aika in southern New Guinea. The lack of parental authority in this region is one thing that makes it difficult to administer these natives. Husbands live apart from their wives and see them only on specially arranged occasions, while the young men go to live in a separate house where they are trained in fishing and hunting by the experienced older men. Children grow up without the usual parental discipline and are the less receptive to governmental authority. "The object of the government," writes Mr. Nejame, "is to induce the unruly tribes between Aika and Merauke to settle in neatly laid out kampongs and to accustom them to a more organized existence. The people of The Netherlands have shown themselves to be remarkably good colonial administrators, and one is encouraged to think that here the sudden contact with civilization which has ruined so many primitive tribes will be avoided by wise policies."





THE CLANSMAN

One of the most realistic natural works of art ever discovered: an impressive formation found in the cave whose recent exploration is recounted in the accompanying article. The white mantle shrouds an older formation of dark yel-

low and brown in the form of a huge cruel face. From the figure standing at the right an idea may be gained of the massive proportions of this perfect caricature of the fantastic Night Rider of the past

EXPLORING A NEW CAVE—*Remains of animals and pottery 1000 years old are found amid the unearthly splendors of a recently discovered cavern in the Guadalupe Mountains of New Mexico*

By R. M. P. BURNET

EXPLORATION has many meanings. To school boys it brings visions of adventure in which untamed Indians and hard riding cowboys play a prominent part. To mature men it suggests far off lands, of tropics and jungle, or perhaps the South Seas and their islands of languor and ease, or maybe the deadly expanse of Polar ice with the silence and lonely vigils of a few men seeking scientific data. To girls and women it is the substance around which romantic dreams are built.

The exploring of places that are not known, however, lacks much of the glamour with which it is invested. Explorers are more often than not quite ordinary men who are seeking verification of some theory or an idea that has definite value to the world. The strange things encountered are to them just a part of the day's work and often seem rather drab and colorless, having little bearing upon the real purpose of their work.

Cave exploring is much like that. It has been my good or bad fortune, as the case may be, to explore many caves in the Guadalupe Mountains of New Mexico. I have had strange and rather hair-raising experiences, but to me they have seemed only incidental to the object of my search—prehistoric man in America, who left evidence of his passing in the Caves of the Guadalupe Mountains of New Mexico and Texas.

Well concealed

It was in this quest that I had the good fortune to explore the vast, new cavern that I am going to discuss. This cave was well concealed by a fall of rock from above covering the mouth so that it was invisible from above or below. It was thus one of the few to escape discovery by the early explorers who searched for guano (bat droppings) for fertilizer. The flight of bats which drew the cowboy Jim White to the discovery of the Carlsbad Caverns and revealed other caves in this region, did not disclose the location of this cave, for there has been

no flight of bats from it since the first white man entered the region or earlier. Why bats desert a cave like this, I cannot answer, but I do know that it is not the first case I have observed.

And so this cave remained unknown to science until several months ago. None but the carnivores that dwell in the region made use of it, and it was left alone in its silence and darkness. The slow seepage of water from the surface many hundred feet above dissolved the limestone through which it passed, and trickling to the floor of the cave, covered the vast deposit of ancient guano by a deposition of limestone to a depth of from three inches to a foot.

The discovery

The first white man to see the cave, despite many claims to the contrary, was Tom Tucker, a goat-herd. His story has little of romance. He lost some goats one day, and hearing them bleating far below the place where he had last seen them he made his descent from the cliff top. After much effort he arrived where he could see some of the goats, but upon starting them up the mountain he found many of his goats missing. Soon he heard the bleating of the others, faint and as though on a lower level of the mountain. In his search for the missing animals he located the mouth of the cave and went in and there found the rest of the goats on the talus that sloped sharply downward from the mouth of the cave to the darkness below. Driving the herd before him to the top of the mountain he thought no more about the cave. It was just another incident in the trials of herding goats in the Guadalupe.

One day Mr. Tucker met an elderly man who said he was looking for guano caves, and Mr. Tucker told the gentleman, Mr. C. J. Cavender, about this one. It might have some guano in it, he said, though he did not know as he had not gone in far.

This was on the 26th of July, 1937, and the next day Mr. Cavender went into the cave equipped with a gasoline lantern. He found guano, lots of

it, and going farther and farther back in the cave he saw huge, beautiful formations, most of them covered with a white mantle like new-fallen snow.

He rushed to town early on the third day and filed a mining claim, convinced that the cave contained nitrates. With the aid of some friends he was able to include all of the cave within the boundaries of the several claims.

Through friends I heard about the cave and that it was very large, but paid no immediate attention to the matter. However, in February, 1938, Mr. J. W. Russell, Special Agent for the Department of the Interior, in the course of his duties went into the cave and saw a deposit of bones. Mr. Russell cautioned the men present not to disturb the bones and told them that he would send me out to take care of them as they might be of scientific importance. He then walked through the other portion of the cave. On the next day he told me that the cave was beyond description in size and beauty. I made arrangements to go to the cave on Sunday, February 13th, taking some friends who wanted to see it.

Equipped with gas lanterns and flashlights we started forth for Slaughter Canyon, where the cave is located, ten or twelve miles south of Carlsbad Cavern National Park. I took my camera and a supply of flash bulbs so that I might take pictures of the bones where they lay in place.

At the foot of the trail leading up the mountain the equipment was divided so that no one was overburdened. As we wound up the face of the mountain the view became more entrancing with every hundred feet of ascent. Considering the terrain the trail, which Mr. Cavender had spent many hours of hard labor building, was an excellent piece of work. In places the drop was so steep that any misstep would have been fatal. The cave was perhaps 700 feet above the foot.

Entering the past

Any attempt to describe the feelings one has as he enters a cave of this kind is far beyond my power. There is a feeling of awe, of an indefinite sort of fear and at times a chill ripple seems to travel up the spine—possibly a throw-back to the hackle that rose on our remote ancestors ages ago.

The floor sloped very steeply and was covered with loose rock that made the footing anything but secure, and as one reached the bottom of the talus the cave began to take form, although at this point very little formation could be seen and that only in the part of the cave which lay to the left upon entering.

The general effect is as if there were two caves

with a common entrance vestibule. The division is sharp, and the left hand side slopes down steeply for about 50 feet. Then, the huge size of this part of the cave is seen in all of its glory. On the right is a giant column that extends from the floor to the ceiling, the size of which dwarfs a human being. To the left are many stalagmites which seem small until approached; then one suddenly realizes that he has begun to lose all sense of proportion.

The floor, ever sloping downward, now turns to the right. I have never beheld a more awe-inspiring sight than that which greets the eye, dimly it is true, for the vast space has absorbed so much of the light from the lantern and there is no longer the faintest glow of light from the vestibule.

Filling the whole space of the corridor which is getting narrower are two huge stalagmites, twins that have a common base—a base that is raised by gentle degrees in a series of step-like forms of gleaming onyx, and above them tower the huge twins reaching towards the true Gothic arch that is above.

A natural cathedral

Here a person must be made of very crude clay, indeed, if he does not have a feeling of awe and reverence, an appreciation of the insignificance of man and his works as compared with those of Nature. The thought comes that only God could have created such a beautiful setting; nowhere in the world is there a cathedral that can compare with this one far below the surface. One seems to expect to see the forms of priests and servers enter from the alcoves.

After the pause that one instinctively makes to absorb the beauty and grandeur of this sight, we advanced and though we could at first see no way of passing this towering mass there was a passage leading behind it into a hall of columns—columns so thickly crowded that one must wind in and out through them to reach the end or the apparent end of this hall.

It was here that the bones of the deer were found, articulated to a great extent, and what was presumably the remains of a meal for the cubs of some very large carnivore, a mountain lion perhaps. But the look of age is on them, and one wonders exactly what manner of animal it was that brought forth and nurtured its young in the silence and darkness of this hall of columns.

Just around the end of what at first appeared to be a blank wall is a continuation of the passage, and on the right and about 30 feet from the first pile of bones far back in a low, small chamber was the second animal. It, too, was deer, but a female,

and was much like the first in size and form. The opportunity of photographing the bones in position made it seem that the trip had been well worth all the effort. The other members of the party, however, were not quite so interested in bones as I, and were asking to be shown what lay to the right of the vestibule. We retraced our steps and came to the right-hand opening, seeing above us the light from the outer world again which although of no help to us when we entered now seemed to blind our eyes which had accommodated themselves to the total darkness of the chambers we had just left.

The pathway led us over a pile of fallen rock, and then we were once more in total darkness except for the lights we carried. Here, indeed, were vastness and detail, columns and stalagmites of huge size. From the ceiling far above our heads hung stalactites, shimmering and gleaming with life from the lights we carried. Eager voices were hushed as they called to one another as though in awe at the splendor of this great hall. Faintly visible high overhead was the arch of the roof, and the lights failed to pierce the darkness that lay around us and before us. Under our feet was the dusty guano of long dead bats. We paused to drink in the beauty and grandeur of the scene.

Occupied by ancient man

We then advanced until we stood at the base of a bank of stalagmites. At their left was a pool of water which Mr. Cavender said was so full of nitrate that it was impossible to drink it. A few feet in front of the base I saw sticks of wood, parts of branches of pine trees, and small twigs. My heart leaped, for here, indeed, was a find. This could have been the lair of the Ground Sloth, a large mammal long extinct, that I knew had lived in these mountains when the vast ice sheets of the Wisconsin Glacier were spread over half of North America. I then got down on my knees to look more closely at the material, and I could not believe my eyes. The wood was all charred; never before had I found evidence of man's occupation of a large cavern yet here it was, and the mantle of age could not be mistaken.

Then one of the ladies in our party said to me in a quiet hushed voice, "Is this pottery?"

Again I could not believe my eyes. I turned the shards over in my hand and there on the other side was a decoration that could spell but one thing, Pueblo Three, or the period of great building a thousand years ago. What a succession of wonders this cave held, and yet I had only penetrated 500 feet into its depth. With the help of the others I

sought and found more of the pottery, parts of four vessels in fact.

We then resumed our journey over a hill of rock that had fallen in the forgotten past, parts of it buried under great depths of ancient guano that in turn were covered with a coating of flow-stone that at times broke through beneath our weight. Herein lies one of the ever-present dangers of cave exploration, the possibility that one may break through thin coatings and go down into holes that seem to be bottomless. Yes, death is not far away in such places but stalks always in the dense darkness that is on every hand; at times one fancies that he can feel its chill breath and perhaps it is not fancy at all.

Leaving the place where the pottery was found, we ascended a large mound of fallen rock, keeping to the seemingly more solid flow-stone; and as in Carlsbad Caverns this gave the sensation of mountain climbing though at this time we were about 800 feet below the surface. The footing was difficult and one was torn between the desire to look at the formations that were on every hand and the necessity of keeping the eyes on the floor.

We dropped down into a miniature valley, on either side of which were vast deposits of guano covered with the ever-present flow-stone, which for some reason was missing in the small valley. Then another slight climb and we stood on a high promontory, the low floor below us with its intense darkness seeming like a sea. Rising from this inky blackness on every hand were more lovely columns and stalagmites.

No two formations alike

Many years ago a cow puncher had shown me a cave and I made the remark that many people make: "All caves are alike; if you see one, you have seen them all." The cow puncher objected in his quiet drawling accent, "You're wrong, brother; if you look close, you will see that no two things in a cave are alike. Sort of looks like when God made these here formations He broke the mold." As time went on and I examined more caves I knew that the words were true. No two formations are alike in color, texture, or form.

So it was that these columns and stalagmites were of interest to me. On one side of the wall there was an opening that was a maze of formations, rising tier upon tier to the lofty ceiling, and I had the party pose to photograph them amid the beautiful surroundings. While setting my camera I saw at my feet the reason for the extreme darkness of the floor. It was absolute black in color and quite dull, and therefore absorbed so much light that one could not see the details.



(Above) A GIGANTIC UNDERGROUND CHAMBER whose proportions, as revealed by the figures shown, stagger the imagination: a scene near the spot where ancient pottery was found. Until several months ago this cave, located 10 or 12 miles south of Carlsbad Cavern National Park, remained unknown to science. The first white man to see it was a goatherd, Tom Tucker, who discovered it when following some goats that had strayed

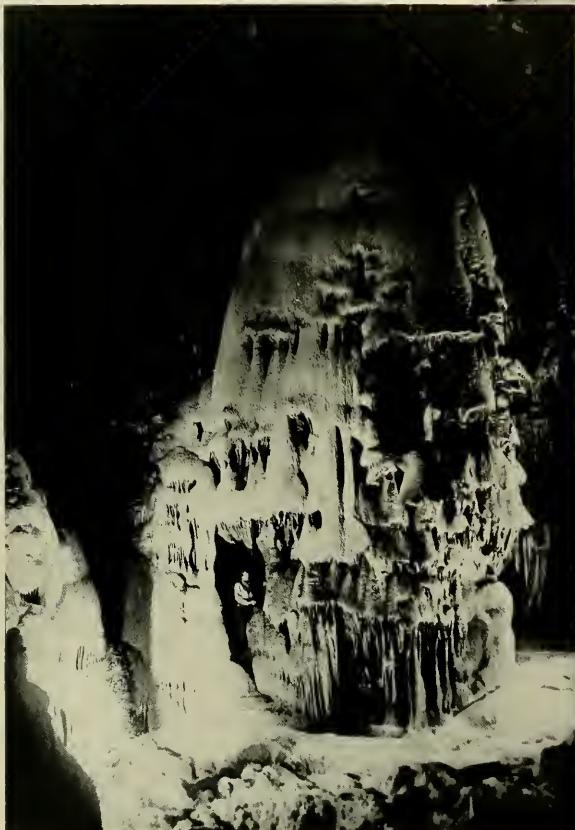


(Left) R. M. P. BURNET, the author, and Mr. C. J. Cavender entering the cave on their tour of exploration recounted here

(Right) FLASHLIGHT BULBS illuminate a beautiful subterranean alcove which probably had not been lighted since the dawn of time unless by the dim fires of prehistoric man. Unlike many other caves in the Guadalupe Mountains, this one had not recently been occupied by bats, though large deposits of guano found in it may be valuable commercially

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(Below) LIKE A CHRISTMAS TREE half buried in sifted snow, this massive stalagmite, many times as high as a human figure, lends the enchantment of winter to the corridor it adorns

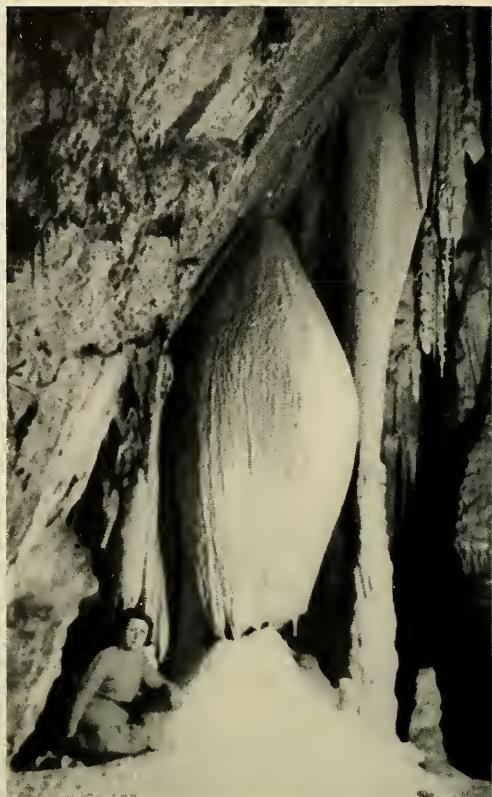


(Right) PERHAPS the greatest of all stalagmites in America. From a base exquisitely draped in fold after fold of translucent onyx, the column rises majestically into the measureless blackness of the dome. Notice the size of the man at the base





(Above) THE WALL of the Tear Drop Room baffles description with its pastel shades of pink, yellow and brown beneath a snow-like mantle



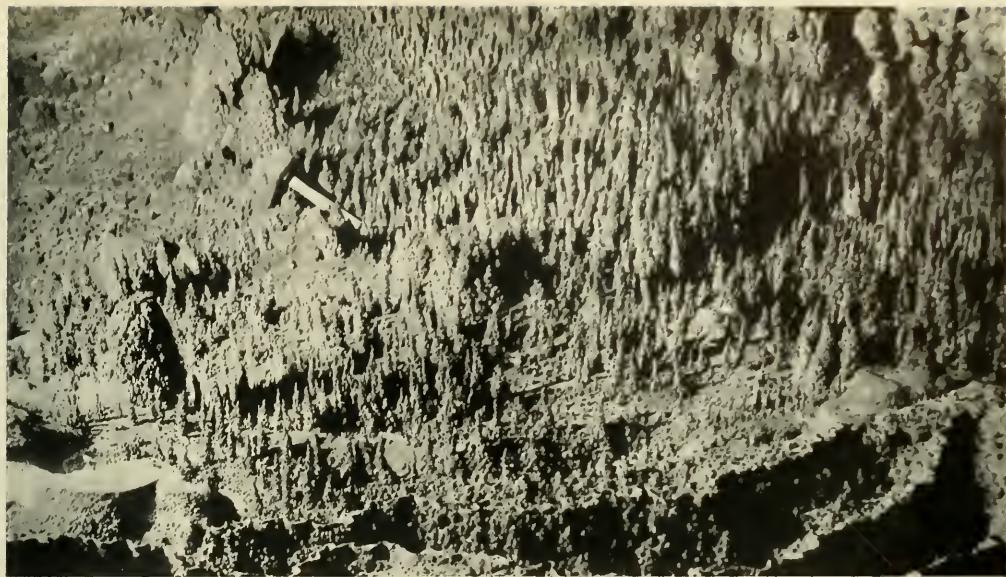
(Above) THE TEAR DROP: a massive, cream-colored globule hanging by such a narrow, frail-looking connection that it seems a challenge to engineering science

(Below) PRESUMABLY THE REMAINS of a meal for the cubs of some large carnivore: the bones of a deer which were discovered in the cave and appeared to be quite old



(Below) DETAIL of jaws, skull and other bones of a second deer found 30 feet beyond the first animal, far back in a low, small chamber





(*Above*) THE BLACK FOREST. As the party progressed along a passageway which narrowed to 12 feet, the air became oppressively hot and the color of the floor became

dull black. At two places the formation shown above was seen, whose resemblance to a miniature pine forest makes its designation obviously appropriate



(*Above*) THE GREAT WALL OF CHINA like ribbon candy wends its way over a coal-black floor about 1000 square feet in area. Through the center of the "wall," which is 12 to 14 inches high, runs a thin layer of creamy white

(*Left*) POTTERY FRAGMENTS of the Pueblo Three type, which prove that the cave was occupied by primitive man 1000 years ago. This was the first evidence of human occupation in a large cave ever found by the author in his extensive searches

Rising from the middle of the floor at this place was another beautiful group of columns and stalagmites. Beyond them the walls were a mass of formation with a river of gleaming stone which appeared to be coming from a dark canyon-like recess in the wall. What may lie behind these formations I do not know, perhaps some day I shall be able to work my way through them and see other beauties.

In the foreground in front of the stone river could be seen the Chinese Wall. Like the ribbon candy of our youth, it wended its way in every direction over a coal-black floor. The height of this queer form is from four to twelve inches, and it covers an area of about 1000 square feet. The floor and the outer side of the walls are coal black, while in the center of the wall is a thin layer of creamy white. The thickness of the wall is about three-quarters of an inch, and the general effect reminds one of the Great Wall of China. I have only seen this type of formation in one other cave.

The journey was once more resumed, and after traveling over some very rough ground we passed a large pure white mound and turned sharply to the right into a narrow corridor. We had seen many beautiful things, but I have never either above or below ground beheld such a scene of breath-taking beauty. It was like a scene in a northern forest with snow-covered pines, and the huge size of the principal stalagmite that stood in the center of the room caused many of us to gasp in amazement.

"Christmas tree"

Larger by far than the famed Rock of Ages in the Carlsbad Cavern towered this giant, the underneath portions being of a creamy yellow and the whole covered by a later deposit of snow-white formation having all the effects of pure, new fallen snow. The thoughts of everyone can be expressed in the hushed exclamation of one of the ladies, "A Christmas tree!" Truly, it bore a striking resemblance to that Yuletide symbol.

Then an amazed gasp from one of the party caused me to turn, and I beheld a type of formation that I have never seen in any other cave. This odd, beautiful, cream-colored formation was instantly named The Tear Drop. How descriptive this is can be seen from the picture of its lovely symmetrical form suspended from the ceiling by such a narrow, frail-looking connection. It seems impossible for this example of Nature's handiwork to remain upright, but there it hangs, a challenge to engineering science.

To attempt to describe the beauties of this room would require the artistic appreciation of Rembrandt and the oratory of Socrates, and with even that

ability a description of the pastel shades of pink, yellow, and brown beneath the snow-like mantle and the grandeur and majesty of the ensemble would fall far short of completeness.

With great reluctance we passed from this chamber by the way we had entered, and as we came out from the confines of the arched passage we beheld the most grotesque formation I have ever seen. We had noticed a pure white mound but had given it little attention; now we were seeing it from another angle, and the sight would strike terror into one with a faint heart. The white mantle shrouded an older formation of dark yellow and brown, the whole effect being that of a huge, cruel face beneath a white robe.

Small stalactites hung from the bestial upper lip, giving the appearance of monstrous fangs. The jutting chin hangs slack, and stains at the sides of the mouth make the figure appear to drool. There could be no doubt that this figure should be called The Clansman, for the white robe and the whole general effect was a perfect caricature of that fanatic night-rider of the past.

We then skirted the wall of the big room and once more climbed a large mound of fallen rock rising against the wall. At the apex of this mound was a high, wide opening, through which we made our way. The air was quite fresh at first.

Far below the surface

The going was rather bad. In places there was a dry, yellowish powdery substance, quite soft under foot, and in other places the floor was solid flow-stone, but ever the way led down until we were very deep in the heart of the mountain. The heat became oppressive and the air very bad, but still we went on and at last reached bottom, where the passage narrowed down to a width of about twelve feet. The character of the formation changed, the color becoming a dull black; and across the floor at intervals of about 18 inches were queer dam-like dykes, the form being a series of scallops, thin and delicate with the upper edge crenellated, the whole being extremely fragile.

Inclosed between these dykes at two places was a formation which resembled a pine forest as seen from a distance. A name was forthcoming at once, "The Black Forest," and as the picture will illustrate, the name is very appropriate for this miniature forest of stone.

The climb out of the tunnel was difficult with the heavy equipment; the distance from the Big Room to the Forest is 1000 feet and we were much relieved to breathe once more the fresher air of the

upper room and enjoyed the cooler temperature of the higher level.

Back in the main room once more we proceeded farther back, climbing over and around great fallen masses of rock, down through narrow aisles between toppled giants of remote age. Then, before us was what looked much like a more or less recent rock slide, enormous blocks of stone, some the size of small houses and grading down to small pieces the size of a football. Over it all is a film of onyx, damp and clammy to the touch, the color being dark brown and seeming to absorb the light as did the black material farther back. I experienced a queer feeling of fear, a feeling that I find impossible to put into words, and then came a cry, "For God's sake, look!"

Everyone turned toward the speaker, and then I saw towering high above us, its top lost in the darkness, foot after foot of gleaming, symmetrical massiveness, the greatest of all stalagmites perhaps in

America, far greater than the Giant Dome in the Carlsbad Caverns, both in girth and height. At the base were told after told of drape-like onyx, translucent when lights were thrust between the gigantic folds, folds big enough for a man to step between, and above that a gradual increase in diameter to about 20 feet.

And so with this climax to a day of surprises and enchantment, we started the long, rough half mile journey through this room of wonders to where the warm sun of late afternoon bathed the mountain slope.

We had seen a cave not as large as Carlsbad Cavern, not as extensive, with no smooth trails or elevators or concealed lighting that turns the darkness into day, but we had seen it just as some primitive American found it a thousand years ago, and truly as the cow puncher remarked, "When God made it, He broke the mold."

APPLICATION FOR MEMBERSHIP IN THE AMERICAN MUSEUM OF NATURAL HISTORY

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THE STORY OF AMBER

Continued from page 357

by the Baltic from her hidden stores come also from secondary deposits, from layers of blue earth.

Although scientists do not know primary amber deposits—and do not have much hope of ever finding any—they have been able to derive an amazingly complete picture of the original amber forest simply from the included fossils. These inclusions not only look beautiful, they also preserved the minutest detail of the animals that were caught in the flow of resin and of the small bits of plants that were enveloped by it. Even though the samples are small they cover many details. There are pieces that formed inside the tree trunks and show the structure of the wood. Equally important, however, are the amber pieces that hardened in free air.

First those that show parts of plants:

There are needles of *Pinus cambrifolia*, flowers of *Pinus Reichiana* and *Pinus Kleinii*. Pollen of pine trees was preserved, the particles showing two membranous air bags like those of our time; and there were pieces of pine wood, sometimes torn by storm or by lightning. There are parts of palmettos, of magnolias, of several varieties of chestnuts, of olive trees and soap trees, of beeches and maples, of flax, smilax, sandalwood, geraniums, camellias and mistletoes, of mosses, fungi and lichens, and probably (the classification is uncertain due to the smallness of the parts preserved) of willows and elms.

Of animals, flies and ants are most abundant, but there are also beetles of many sorts, mosquitos, wasps, bees, moths and termites. There are primitive wingless insects allied to present-day "sugar lice," many roaches and spiders, and a relative of the "book-scorpion" of our time. There is even the famous *Palaeopsylla klebsiana*, the only fossil flea known to science. It seems that it lived on a small animal before it got into the amber resin, possibly on a small rodent. A single tuft of hair is not classified with certainty, at first it was believed to come from a squirrel, but it might have been a small marsupial living in trees.

All finds considered, the amber forest comes to resemble a subtropical forest of our time but with many pines in it, so many that some areas probably consisted only of pines. In trying to imagine the dimensions of this amber forest one is soon lost in a tangle of unbelievably large figures.

The amber mine at Palmnicken started in 1875 with a production of about 500,000 pounds of amber per year. In 1895 a production of about 1,000,000 pounds was reached, which was kept up fairly steadily until the World War. In 1924, again, the yield set a record of 1,100,000 pounds which has not

yet been broken. All in all about 36 million pounds were mined from 1875 till 1936. And this from only a fraction of the deposits!

It is impossible to say how much amber was fished from the sea since Roman times or how much more remains in undiscovered primary deposits. In 1862 not less than 4500 pounds were found near Palmnicken in a single night. A stormy night in February, 1914, yielded almost 2000 pounds near Rauschen. Even the small and now apparently exhausted deposit in the bottom of the North Sea yielded comparatively large quantities, one Danish amber merchant recovering about 700 pounds on the Jutland coast between 1822 and 1823.

Another figure more impressive than all the others pertains to the collection of fossil inclusions belonging to the Geological Institute of the University of Königsberg. This collection, preserving only the finest specimens numbered 70,000 in 1914!

It must have been a truly gigantic forest, living for countless centuries, to have produced this wealth.

"Succinosis"

The struggle for life must have been hard in this forest. We cannot reconstruct the struggles of its animals except of the insects that were caught in the sticky amber and died struggling to free themselves; but we can assume that the pine trees must have been attacked by legions of forest pests devastated by storms and lightning. Wounded possibly by woodpeckers and small mammals these pines produced resin and again resin. What started out as a beneficial healing process apparently developed into a disease in the end. Conwentz, one of the ablest investigators of amber coined the term "succinosis" for this disease, a continuous pathological over-production of resin that finally may have killed the trees themselves.

It must have been a strange forest, this amber forest primeval, strange and oddly familiar at the same time. We know well how it looked, but we do not know where it grew. We know when the product of this forest was amassed in the places where we find it now, but we do not know when the forest grew. We possess a wealth of Baltic "sea gold," but can find no explanation in the modern world to account for the tremendous accumulation of it in one place. We suspect a strange tree disease and we have very good reasons to do so, but we know nothing about it. There are gaps in the story of amber and there is not much hope that they may ever be filled. But we see that this story is a fascinating one; and in spite of the riddles that amber presents, it has contributed in no small way to related branches of science.

THE INDOOR EXPLORER

Middlemen of Dinosaur Resurrection: the "Jimmy Valentines" of Science

To the casual Sunday stroller through Museum exhibition halls, the question of how dinosaurs and other fossil forms that occupied this globe when it was very young reached the glorious estate of mounted specimens is a very simple one. One gentleman went out into the field and dug up the bones much as the suburban gardener inadvertently upturns the bone-cache of his neighbor's hound. The bones were then, the reasoning proceeds, turned over to another fellow who pinned them together with wires and what-not, and then set them up in the Dinosaur Hall. There are two things wrong with this picture. First, the fossil-digger has learned, painfully, that wherever there is bone there is usually stone. Secondly, and consequently, the gentleman who dug the bones can't give them directly to the man who pins them together without finding some way of getting rid of the stone. This is accomplished by a middleman—a very important middleman that the casual stroller seldom knows anything about.

The most expert skeleton mounter in the world could do absolutely nothing with the specimens that Dr. Barnum Brown, Curator of Fossil Reptiles, brings in to the Museum from the badlands of Wyoming and other rich fossil fields. For, although these specimens will eventually become skeletons, you would never suspect it from their appearance when they arrive in the Museum. At first glance, they look like variously sized chunks of jagged rock. At second glance, you perceive that some sections of the rock surface look different from others. And at third glance, with the help of an informed companion, you can learn to distinguish fossilized bone from the solid rock setting which seems ever so much more reluctant to yield its bone treasure than even the contents of a gold vein.

The middleman is the fellow who has the extremely difficult job of extracting the bone absolutely intact from the stone vise in which it has been held for millions of years. Natu-

rally, there isn't just one middleman. Doctor Brown has a large laboratory manned by several of them. Each one has some special attainment, each is an artist in his own right, and after years of working with them, Doctor Brown has learned how to assign to each the type of problem which he is temperamentally most suited to solve.

Of course, the analogy of the middleman does not quite hold true. Many of these laboratory workers double in performing the function of mounting the skeletons as well as handling the "raw material." Charley Lang, for instance, is peculiarly gifted in this art. His iron supports for the gigantic dinosaur bones show the hand of an anatomist with an astonishing feeling for natural posture. Then there is Alastair Brown who assembled the intricately articulated Pterodactyl. Another, Jerry Walsh, is a seven-day wonder at fitting and piecing tiny bones together. Albert Thomson after years of practice, has learned to solve the trickiest of fossil problems requiring great delicacy of touch. And so it goes. Doctor Brown has found each of his assistants invaluable and irreplaceable in his own way. The fossil exhibitions in the American Museum, famous throughout the world, are what they are because of these laboratory men. Without them there wouldn't be any exhibitions and the scientific knowledge of the prehistoric world would be, if not non-existent, extremely limited. Few other institutions possess such craftsmen; and Doctor Brown and his associated scientific diggers have depended to a great extent on them and their opinions. Doctor Brown points out that all the abstract theorizing in the world about the articulation of fossil bones and their significance would be of little value without the practical experience of the men who extract the bones from their rocky matrix and build them into skeletons. It is impossible to select one man in the palaeontology laboratory as supreme over all the others. The work is of such a co-

operative nature that it cannot progress without a perfect spirit of teamwork in which each contributes an indispensable share of skill. But as a typical case we turn to Mr. Otto Falkenbach, dean of these laboratory craftsmen and symbolical of their art.

He is a veteran of thirty-six years in the American Museum and not until you have seen him at work can you have any idea of the complexities and amazing dexterity involved in the transfer of fossil bones from matrix to skeleton. Mr. Falkenbach's specialty is extracting the smallest, most fragile bones which a hand less sure than his would fragmentize and thus render useless to science. This Indoor Explorer found him squinting through a microscope and daintily picking away at the skeleton of a tiny prehistoric flying reptile in a slab of lithographic stone. Near him, another worker was chipping much larger bones out of rock with hammer and chisel. Less delicate work, perhaps, but requiring infinite care. If the chisel were just a trifle out of line, it would be a calamity for science—just as would occur if Mr. Falkenbach were to exert the smallest imaginable unit of extra pressure on the slender steel probe in his hand.

"That rock he's working on is so hard it might just as well be flint," Mr. Falkenbach said, indicating his colleague whose hammer clanged incessantly on the chisel. "He soaks the bone parts with brown shellac before he starts and that not only gives them some added protection and cohesion, but it also helps his aim by marking them off more clearly from the rock. Now this stone I'm working on isn't nearly as hard. But you see that leg bone?" He pointed at a thread of bone scarcely larger than a needle that was distinguishable from the rock surface. "Well, I've got to keep picking around it until I get it out of there." Mr. Falkenbach shrugged aside the suggestion that this was perhaps his most difficult assignment. It seemed it was day in and day out work with him and that in his time he had separated

bones from their rock bed far smaller than this one.

Compared with Mr. Falkenbach's problems, the legendary trick of carving sonnets on cherry stones is mere child's play. His tools are the most delicate precision instruments now being manufactured. From the cambrie needle, finest of all pointed tools, they stretch through the whole array of dentist's probes, picks, chisels, even electrical drills, up to heavy chisels like the one used by his nearby colleague. But practically all his work is of the hairbreadth variety and must be done under a powerful microscope.

When separating out transparent cartilaginous bones so thin he hardly dares breathe on them, he gives them as much protection as possible by gluing strips of rice paper to their exposed surface. This operates in much the same way as shellac does with larger bones.

school for this work. Mr. Falkenbach can tell a fossil bone chip from a pebble even where the bone structure cannot be seen by his sensitivity to the feel of its texture and the direction of its grain under the microscope. Dentists trained to distinguish the "touch" of pick on sound enamel from that on a decayed section of the tooth can understand how this same feeling for the difference between bone and stone is communicated to Mr. Falkenbach's exceedingly receptive fingers through the highly tempered precision instruments. Yet the pressure on Mr. Falkenbach's nerves is perhaps greater than that on those of even the busiest and most painstaking of dentists.

"Yes, the strain is terrific at times," he told the writer, "and I find as I grow older that I can't work as long at a job as I used to. But it's the kind of work I've always liked

received its first discipline in carving fragile little figurines on the finest plate. This early training developed the infinite patience that is the primary requisite of any craftsman engaged in an extremely intricate but rather rigidly formalized art. It was, however, not because of his experience as a silversmith, but as a sculptor that Mr. Falkenbach first came to the Museum. At that time he had a cousin under whom he had learned much of the art, who was a celebrated Indian sculptor in the Museum's Anthropology Department, and through him, he learned of the fossil department's need for a sculptor. He started his work modeling a missing clavicle for a Brontosaurus and he has been here ever since, learning the dinosaur business from the ground up, or more precisely from the clavicle down.

Doctor Brown considers the day Mr. Falkenbach came to work for



Another branch of Mr. Falkenbach's work is sorting out minute fragments of fossil bone from loads of gravel. How trying this is on the eyes, nerves and patience may be imagined from the fact that fossil bones take on a kind of protective coloration and often greatly resemble in color and form the rocky matter in or with which they are found. Grueling years of experience are the only

and when I was a young man just starting out I'd get bored with any other job almost as soon as it began to get easy for me. Finally I got this one at the Museum where Doctor Brown can always give me a tough nut to crack any time I want one."

Mr. Falkenbach started out as a silversmith. In this line his seemingly innate craving for close work involving deftly handled small instruments

the Museum a lucky one for his science. Not only did he bring with him the combination of rare skill with a patience that is little short of unique, but his inventions for preserving the infrequently found specimens of fossil skin and other rare phenomena threatened by decay have enabled him to save invaluable specimens which most men in his field would have given up for lost.

Mr. Falkenbach's ability as a sculptor has been employed throughout the years in modeling the missing bones of fossil specimens. A typical problem for the sculptor of missing bones is one in which all parts of a given prehistoric animal have been recovered except, let us say, the left thigh bone. In order to mount this specimen, the missing left thigh bone must be fashioned out of plaster. By creating an exact replica of the right thigh bone in plastoline, Mr. Falkenbach is able through his knowledge of anatomy to calculate the shape and dimensions of the missing bone and cast it in plaster. Mr. Falkenbach's skill in modeling these missing bones is exceeded by only one other craftsman who is no longer with the Museum. This gentleman has now become a legendary figure because of his remarkable ability in this particular phase of the laboratory work. He could take a piece of plaster, look at the right thigh bone and whittle the left thigh bone faultlessly in a single operation. The reader can best realize the mental hand springs involved in this feat by trying to write backwards with his left hand.

Lest the layman look askance at the orthodoxy of incorporating plaster bones in mounted skeletons it might be of interest to state the unwritten laws of such reconstruction work. If two-thirds of the animal have been found, it is permissible to reproduce the missing one-third and put the completed animal on exhibition providing the missing parts are known in another specimen of the same species. Or if the missing one-third is present in another skeleton of the same species but of a slightly larger or smaller size, it is permissible to reproduce missing parts by copying the bones of this other skeleton, either reducing or enlarging them according to the size of the first skeleton. And lastly if a right leg is found, but no left leg—it is perfectly good form to duplicate the left leg by copying the right leg in reverse.

Mr. Falkenbach, however, gives more scope to his sculpting abilities than that demanded by this reconstruction work. Some years ago while wandering through the Bronx Zoo he noticed that most of the visiting throng around the elephant cage were completely oblivious to the differences between the Indian, the African and the Pigmy elephants. Surprised at this, he made inquiries around the

Museum's Education Department and discovered that the same thing was also true of the young visitors in the Museum. To them an elephant was an elephant and nothing more. Determined to enlighten the public, Mr. Falkenbach decided to model a series of the different types of elephants on such a scale that they could be reproduced commercially and used by teachers to illustrate differences in animal types. But once started in this direction he soon became convinced of the need for similar series of other animals. He had roughed out small models of the elephants from the earliest known type to the African and Indian species of today. But before completing the finished product, he was sidetracked on a series of dinosaur models from Protoceratops on down and even began work on a deer series with similar ends in mind.

In order to show the development of anatomical changes the accuracy

been discovered in the dinosaur grave yards that the consequent influx of material to the Museum has necessitated the concentration of all his energy on separating bone from stone. So the elephant models have stood untouched on their shelf for the last six years.

There are so many specimens and so few craftsmen that even this work is conducted rather sporadically. Many specimens are only partly mounted and then held incomplete while another lot of "raw material" is investigated.

The idea is to separate as much bone from stone as possible and to catch up on the mounting at every breathing space. Obviously, Mr. Falkenbach and his colleagues are the key men in this process. That they or those like them will always be the key men cannot be doubted for the fossil fields are largely untapped and Doctor Brown feels that the surface has scarcely been scratched. Furthermore



of such work had to be unimpeachable and the modeling consequently difficult. The artist first constructed an armature with lead supports then covered it with plastering. The muscles were carefully delineated, then the detail gradually moulded in. Mr. Falkenbach has also done some experimental sculpting using paper, liquid rubber and an unusual sort of Japanese glue.

The sad truth is, however, that none of these series was ever completed. They had to be done on his spare time and there was precious little of that. If Mr. Falkenbach could spend his entire time on a single model, it would take him about a month to achieve an anatomically flawless and esthetically pleasing little statue that could be turned over to the manufacturer. But so great a volume of specimens have recently

there is little hope for the discovery of a chemical means for separating bones from stone. Fossil bones tend to become impregnated with the characteristics of the stone matrix. If the stone is of a carbonate variety, any chemical solvent for carbonates, no matter how sensitive, would surely dissolve much of the bone and would, therefore, be impracticable. About the only contribution of other sciences to that of fossil finding is the X-ray. And Doctor Brown is now at work on a method of adapting this instrument as a sort of divining rod for the location of fossil bone.

So Mr. Falkenbach's work is imperative to the continuance of fossil investigation. In an age where individual craftsmanship is on a precipitous decline, he becomes with all his years of experience more and more an irreplaceable.

YOUR NEW BOOKS

CHINA'S INVASION BY THE WEST • BIRDS AGAINST MEN
WORLD NATURAL HISTORY • FISHING, FISH AND THEIR LIFE
WEST INDIES • LINCOLN ELLSWORTH • ALASKA'S STORY

THE INVASION OF CHINA BY THE WESTERN WORLD

----- by E. R. Hughes

The Macmillan Company, \$3.50

CHINA is so vast that many people who pride themselves on being generally well informed do not have the courage to even try to learn anything about it save through conversation and the newspapers. To study its history seems almost futile, as does the approach to any other aspect of it. I recommend the present volume as a happy solution of this difficulty. It is written simply and without bias and paints a fascinating picture of the birth pangs of modern China. The fact that a good share of western history is necessarily included dilutes the purely Chinese facts and makes for easy reading. The author has been careful to use a minimum of foreign terms and technicalities without sacrifice of accuracy and historical detail. The result is a readable though thoroughly scholarly piece of work. Mr. Hughes' position as Reader in Chinese Religion and Philosophy in the University of Oxford, together with the fact that he has spent years in rural China, guarantee this.

The invasion of China by the occident affected every aspect of Chinese life; political thought, education, literature, science and medicine are shown to have been revolutionized. Although the effects on religion as such are not dealt with in a separate chapter, Mr. Hughes states that: "Among western cultural influences in China the missionary influence claims right of way for consideration" because it is the oldest in point of time and the largest in scope of operation.

The first fifty pages are devoted to a résumé of the historical background of China's relations with the West, chiefly those of the last hundred years, and each chapter begins with an explanatory portion which serves to orientate the reader who has no background in Chinese affairs.

In the beginning of the chapter on western science and medicine, the author draws a parallel between development of scientific thought in the occident and orient. At about the time that the Greeks were laying the scientific foundation of our culture, the Chinese were doing the same for theirs, and after this period both civilizations entered one of relative stagnation. Whereas Newton and Galileo aroused us from our scientific apathy in

the 17th century, the Chinese did not really come out of theirs until two centuries later, when virtually forced to do so by us.

CLIFFORD H. POPE.

BIRDS AGAINST MEN—Drawings by Lynd Ward

----- by Louis J. Halle, Jr.

The Viking Press, \$2.50

BIRDS AGAINST MEN is a collection of seven essays about birds. The title is somewhat of a puzzle. There is nothing in the text that consistently bears out the idea of any conflict between birds and men, nor are the birds always shown against a human background. Whatever the author meant by the expression has not come out in the book.

Part of the essays deal with certain individual birds and give the author's experiences with them or his observations on their lives and habits. To these notes are added numerous reflections on nature in general and the world at large. In fact, throughout the volume there is no attempt to keep the thread of discourse fastened to the feet of the birds but, instead, the discussion passes at frequent intervals to the consideration of some allied topic that has a bearing on the point at issue. All this makes entertaining reading and removes the essays from the category of pure natural history to make a literary composition of a high order.

From a naturalist's point of view, the text is stimulating. The author brings to his task his excellent powers of observation and a genuine love for birds. His accounts of his own experiences are reliable and interestingly told but there are some errors in certain statements that have come, no doubt, from other sources.

For instance, the fifth essay gives an entertaining account of a family of Kingbirds in their summer home. But the statement may be questioned that almost all the members of the Tyrannidae live exclusively in the tropics, although the majority of them undoubtedly do so. Aside from the thirty-one species that reach the United States there are others in the South Temperate Zone and still others that live high in the Andes of South America in a region that, although within the geographical limits of the Torrid Zone, is far from tropical.

Another questionable statement avers that small birds have not the weight

necessary for high speed in flight. The problem of flying speed is not so simple as to find its answer in mere weight. The shape of the wing and the area of wing-surface in relation to the weight must be considered in any discussion of flight, and mere increase in weight, even with attendant increase in the size of the wings and consequent necessity for still greater muscular development and weight, may reach, in the end, an impasse which will prevent any flight whatever. The heaviest birds do not fly at all.

We are told, also, that the Kingbirds molt in late summer or fall, before their southward migration, so that, when they leave for the south, adults and young are indistinguishable. As a matter of fact, the molt of this species is carried out almost completely in its winter home and young birds are still recognizable as such when they begin their southward journey.

The less said of the illustrations the better. They fail where so many pictures of birds fail that are drawn by artists unfamiliar with avian anatomy and plumage, and are not even consistent in their errors. The book deserves more accurate decoration.

As a final word, it may be repeated that Mr. Halle has not attempted a scientific treatise on ornithology but, instead, has given us an interesting series of essays on nature with birds as the central figures. The volume will appeal to friends of birds and lovers of good literature.

J. T. Z.

WORLD NATURAL HISTORY with an introduction by H. G. Wells.

----- by E. G. Boulenger

Charles Scribner's Sons, New York, \$3.00

IN a past issue of NATURAL HISTORY I viewed a book by Mr. Boulenger entitled *The London Zoo*. My diagnosis was to the effect that it was a useful and elaborated guide-book to the extensive collections of the Zoological Society of London, of which the author is Director of the Aquarium and Curator of Reptiles. In the present work the author has added a much expanded theme. At first glance it would seem that here is a nearly impossible task to be confined to a book of 268 pages—with any hope of maintaining readable continuity. But it does work

out, and Mr. Wells, in his introduction, is enthusiastic about it.

He says: "This is a book to read and then browse over and after that to keep for reference. It will become a key to much other reading. Essentially, it is a catalogue, though a very explicit, vivid and entertaining one. I think that if I were a schoolmaster and I wanted to make a boy into a naturalist I should give him this volume for a beginning and induce him to break up the contents of its neatly arranged classes and orders and drawers and pigeonholes and rearrange them under regional headings. Then I should send him to the school library to find good descriptive travel books, and he would be a dull young man if he was not presently discussing why it was that the largest cat in the continent of America is the puma, why Old World monkeys are so short of tails and why there is neither giraffe nor okapi nor any real equivalent to these animals in the tall forests of Brazil."

When one first notes that Mr. Boulenier's new book reviews all of the orders of the world's mammals to the number of eighteen chapters, has two chapters on birds, six on reptiles, four on amphibians, three on fishes and ten on invertebrates, there being forty-five chapters or sections all told in a book of under 300 pages, it would seem that here is a work limited to mere outlines, without a chance of radial definition. My first impression, before I read it was that it must be more of an encyclopaedia than a readable book; but I was surprised at the ingenuity and care of arrangement. It is a really useful book and contains a great deal of information. There is not much that seems new as regards zoological noting; but there is compilation of points that answers queries frequently cropping up about natural history. For instance, the reader will find the rate of elephant growth and how long these animals live, the length of whales, breed-habits of animals, habits of various rodents including lemming migration; notes on game animals of Africa, when and how the okapi was discovered and like points.

As the volume stands it is compact and handy in referring to gross conditions in natural history, and instructive reading in seeking a bird's-eye view of zoology. The illustrations are particularly good and artistically reproduced.

RAYMOND L. DITMARS.

THE LIFE STORY OF THE FISH. Introduction by William Beebe.

----- by Brian Curtiss

D. Appleton-Century Company, \$3.00

HERE is a book whose title tells in plain language exactly what it really is, the Life Story of the Fish. In his very brief but vivid Chapter I, "Men and Fish," the author tells us the main sources of his book, which are the lore of the anglers, the experience of the aquarists and the experiments of the scientists. We bless him, in passing, for these grateful words: ". . . the more orthodox biologist—the man who permits himself to be called a zoologist or, even worse, an ich-

thyologist—has been looked upon as a dull fellow, and his contributions often have remained unknown to the very people to whom they ought to be of the most interest and value." The author also says that, on the one hand, we have the aquarists and anglers seeking for knowledge of fish; and that, on the other hand, we have a great fund of knowledge about fish stored away in laboratories and scientific libraries. "In one room shelves full of excellent wine in tightly sealed bottles; in the next, a lot of thirsty people with no bottle-openers. To furnish the bottle-opener is the object of this book; to bring all that knowledge out of the musty atmosphere of the laboratory, where it now lies in a state of perfect but useless preservation, and to turn it over, in suitable form, to the seekers to consume; in short, to tell the anglers and aquarists what the scientists know about the things that they want to know."

The trouble with many a book that tries to popularize science is that it is either too popular or too scientific, or sometimes both at once. Moreover, when journalists try to be funny, especially when they say anything about fishes, they are apt to make the scientist sick, and when "real scientists" try to sugar-coat their pills they are sometimes merely pathetic. But this book is different, perhaps because its author cannot be easily pigeonholed in either class. And no matter to which class the reader belongs, public, angler, aquarist or biologist, he will be hard put to it not to be entertained and painlessly instructed by *The Life Story of the Fish*. To paraphrase Patrick Henry, "If this be blarney, make the most of it."

W. K. G.

ATLANTIC GAME FISHING

----- by S. Kip Farrington, Jr.

Kennedy Bros., Inc., New York, \$7.50

THREE well-known figures in the fishing world have combined to make Kip Farrington's book both useful and beautiful.

The introduction is written by one of the world's leading triumvirate of big game fishermen, Ernest Hemingway. Mr. Hemingway characteristically hits from the shoulder at unethical methods that reduce the sport to "a contest of egos on who can produce the largest fish at the dock by any means." If it is to be reduced to this, he says, "then let it become ridiculous as soon as possible." He puts up a strong plea for keeping this sport a sport, not a slaughter in which the fish, already at the disadvantage of having a hook in its mouth, fights panic-stricken for its life while the fisherman uses all human and mechanical aids possible to land it. Mr. Hemingway has described two types of such fishermen in a sentence more pungent than beautiful and already famous in fishing circles. Lynn Bogue Hunt contributes to the drama of the book by his spirited color plates.

Kip Farrington has given us a guide book for game fishing off the Atlantic coast of North America from Cape Breton to the Bahamas, based on personal experience. He tells the fisherman where to go, how to get there, where to stay,

what boats and guides to hire, what tackle to use and how much all of this costs. He goes into great detail giving names and facts, and even the telephone numbers of the Montauk skippers. He not only discusses such giants as the swordfish, marlin and tuna, but also smaller, less rare fishes like striped bass and bluefish. Some pages are devoted to that sportiest of all salt-water fishing, surf casting, and there is a vivid account of the capture of a tuna after a four-hour fight, in storm and darkness in the Gulf Stream off Bimini.

Mr. Farrington's exact information about equipment, localities and fish, combined with his direct style, make this book both fascinating and indispensable to the salt-water angler who, guided by it, can find good fishing every month in the year at some point along the Atlantic coast.

F. LAM.

SOME GLOBE-TROTTINGS WITH A ROD

----- by A. H. Batten Pool

Spottiswoode, Ballantyne & Co., Ltd., Eton

M. R. BATTEN POOLL took with him on his globe-trotting a light trout rod, the observant eye of a naturalist, and a fine hot temper. The result is a conversational and most delightful little book, and his lists of fauna and flora for each section are a real contribution to natural history. He is a keen and instructed observer of both bird and plant life.

He visited some of the least fished countries in the world, with the exception of New England, which is well and pleasantly equipped for all anglers. Yugoslavia provided some of the best and least expensive trout fishing. The Amazon and its tributaries, although failing as fly rivers, are a paradise for bait fishermen, and the author suggests that the enormous *Arapaima gigas* might well offer magnificent big game fishing. The South Sea Islands yielded more beauty and adventure than fishing, except for *Kuhlia malo* which rises to the fly and is plentiful in Tahiti and the beautiful Marquesas.

Iran and southern Russia are a mass of red tape. There are trout in the rivers of the Elburz mountains, and although the Lar, an eight-hour trek from Teheran, is quite a well-known trout stream, the fish run small and a special trip there is hardly worth the difficulties of Persian travel. It was Mr. Batten Pool's intention to fish Lake Sevan, about seventy kilometers from Erivan, but he never got there. He only got daily charges beginning at three pounds, and the loss of a week's fishing for which neither ruins, his politically intense interpreter, nor a collective farm were compensation. And at this point, on page 116, Mr. Batten Pool leaves his rod somewhere in Armenia, and, via North Russia, Dvina salmon and lake pike, begins talking about politicians, the army, and the last and next war, and is still on those subjects on page 123, where the book suddenly ends! I can only say that when I turned page 123 and found nothing, I was quite bitterly disappointed.

F. LAM.

THESE ARE THE VIRGIN ISLANDS

----- by Hamilton Cochran

Prentice-Hall, Inc., \$3.00

LET'S GO TO THE WEST INDIES

----- by George W. Seaton

Prentice-Hall, Inc., \$3.50

THESE books are delightful and profitable reading. Moreover, because of their superb and lavish illustrations, they come close to being an equivalent to a real visit to the places which they describe.

Mr. Cochran gives us not only an amazing array of mingled history and legend but also many a glimpse of the beauty of the Virgin Islands and of the lovable charm of their people. As all too many of us tend to assume that these islands are but dreary goblets of earth teeming with sickly and poverty-stricken folk who never have cause to smile, the author, by showing the falsity of this assumption, has done much to earn the gratitude both of the islanders and of ourselves. In short, Mr. Cochran so portrays the Virgin Islands that the reader is filled with a strong desire to visit them and to linger in them. He does so, obviously, with real affection which is reflected by the singular readability of his narrative.

Mr. Seaton's book deals with all the islands and mainland around the Caribbean Sea (except Nicaragua and Yucatan). Written with plentiful humor, and interlarded with valuable but not too ponderous statistics and historical facts, Mr. Seaton provides us with valid information on topics ranging from how to behave on board the cruise-ship to how to avoid trouble at the U. S. Customs on coming home.

All along the route he tells us what to see and do and buy. It is all admirably well done. Particularly true is the witty passage (on page 289) in which Mr. Seaton comments on the bill-boards which mar the beauty of the La Guayra to Caracas road. There is no sting in it for the Venezuelans because Mr. Seaton shows that we are fully as prone as they to defile our fairest landscapes with hideousities.

Taking the two books together one may say that they are travel and description books of the very best kind. Well written, and in a spirit of genial friendliness, they can do naught but good, whether it be from the angle of interpreting our neighbors to us or from that of encouraging us to visit them and their countries. With Europe grimly sliding toward chaos, travel to lands in our own hemisphere is sure to become increasingly important. These two books foster intelligent and well-bred travel. Without hesitation one strongly recommends that all prospective cruise-makers take both vol-

umes with them. And every cruise-ship should have them in its library.

PHILIP AINSWORTH MEANS.

BEYOND HORIZONS

----- by Lincoln Ellsworth

Doubleday, Doran & Company, Inc., \$3.50

IT is a milestone in exploration when an explorer like Lincoln Ellsworth tells his own story with candor and simplicity. We expect a Polar explorer's autobiography to be full of physical obstacles and natural dangers. This one is also replete with human interest.

The world has known much of Lincoln Ellsworth's accomplishments but this is its first opportunity to know the man, for he has appeared somewhat like an iceberg—seven-eighths submerged. The reader is bound to be surprised at the manifold activities he engaged in in preparation, as railroad surveyor, mining engineer, hunter and explorer in South and Central America and the Northwest, and as chief engineer in laying out the city of Prince Rupert, B. C.

He recalls his boyhood as a frail youth in a family where he could have enjoyed every luxury. At every fork in his road he chose the strenuous path. "When I am away from New York it has long been my custom to take a daily 18-mile walk. In New York I substitute for walking an hour of wrestling with a professional . . . I am still a good wrestler. When I was 30 I was not afraid to meet any wrestler of my weight in the world, amateur or professional."

It might be thought that a wealthy father would facilitate the progress of a young explorer, but not so in this case. His father, after fighting for ten years against his son's chosen career, finally agreed to back Amundsen and young Ellsworth on their long-planned flight into the Arctic. Almost at once the elder Ellsworth began to crawlfish. Out of his defeat he must have some morsel of gain. What he chose to demand was so childish that in any other circumstances it would have been ludicrous. Lincoln Ellsworth was then 4 years old.

"Lincoln," he said, "if I give you this money will you promise me never to touch tobacco again?"

Before he could grow indignant, Lincoln Ellsworth promised and his father signed the agreement.

"Upon mature thought, I deliberately decided not to keep that promise. It had been rung from me by coercion . . .

"Father's signature to the contract was scarcely dry before he was trying to back out of it."

He began a desperate campaign, one that verged on the unprincipled, to keep Lincoln from going, invoking every legal aid at his command. He attempted to have his son's passport canceled and to impound his personal bank account upon which he was dependent for the purchase of parachutes. When the father relented he almost at once reneged again; but finally it was too late and he concluded "Well—I guess—I'm glad of it."

The ship sailed. "With a buoyant step,"

writes Ellsworth, "I walked toward to watch the passage of the Narrows, lighting a cigarette as I went."

Lincoln Ellsworth's career has been a concerted movement back to the frontier and beyond it. He gives as vivid an impression of what it must be like to fly over the frozen polar regions as one could possibly get; likewise of the strains that grow up among men living for long periods in solitude. His narrative culminates with his celebrated flight with Hollick-Kenyon across Antarctica which brought him a special gold medal from Congress for "claiming on behalf of the United States approximately 350,000 square miles . . ." His conspicuous accomplishments have brought him numerous distinctions. Yet to many his book will mean more than the feats themselves, for in it he gives an enthralling personal picture of exploration as it looks from the inside. E. M. W.

THE STORY OF ALASKA

----- by C. L. Andrews

The Caxton Printers, Ltd., \$4.00

CLARENCE L. ANDREWS' *Story of Alaska* is unquestionably the best history of our greatest possession since Bancroft's *History of Alaska* in 1886. In this new edition, Mr. Andrews has added considerable material which includes an excellent account of the most recent developments of the territory.

The book is composed of two parts. The first of these is a meticulous account of the discovery and the Russian occupation to 1867. The second part is a concise story of Alaska since it was purchased by the United States, with rightful emphasis of the facts that it has been poorly governed, sadly neglected, and never thoroughly appreciated.

Conciseness and at times heaviness prevail throughout the book, and unnecessary details frequently pervade its pages. For example, in treating of the conflict between the Aleuts and the Russians, he says, on page 33, "At a landing they sent some of the girls on shore to pick berries; two ran away, one was killed, some of the rest drowned themselves; then, in order to remove witnesses to the tragedy, Pushkareff threw all the rest into the sea, with the exception of two boys." Again, on page 196, in relating the Soapy Smith-Reid fight, he states, "Soapy heard of the meeting, took his rifle, a Winchester repeater, drank a big glass of whiskey, to reinforce his courage . . ." In addition to this wealth of factual material there are fifty pages of bibliographic notes. It is a grand source book and is certainly more of a "history" than a "story" of Alaska.

No one who has been to Alaska, or who has been keenly interested in the development of that great country, can fail to be in sympathy with Mr. Andrews' ardent and startlingly frank plea for the Alaskan cause. For those who are interested in learning more about a land one-fifth the size of the United States, and greater in size and wealth than all Scandinavia, I highly recommend *The Story of Alaska*.

ERICH M. SCHLAIKJER.

LETTERS

Sirs:

In the April, 1938 issue of the *Reader's Digest* appears a condensation of "Mother Goose and Her Family," from the November, 1937, issue of NATURAL HISTORY, of which it seems the author is one Kerry Wood.

Above the article in the *Digest* is a heading containing, among other notations, an invitation to the reader to accept the information as authentic, and running something as follows: "A modern example of the authentic interpretation of Nature, etc."

While there are other matters cited in the article, and which we doubt, we are particularly intrigued with the recitals of the choosing by the Canada Goose of a place for, and the construction of, her nest. In this particular, the article runs along something like this: "They finally chose a place on a platform nest, left by red-tailed hawks, 40 feet above the ground, in the highest tree on the island," etc.

Further along in this same treatise by author Kerry Wood, we find a description of the Mother Goose pushing the goslings over the edge of this nest right after they are hatched, and, of course, of necessity their falling one after another to the ground 40 feet below, where the gander stands on guard; and then putting off to the water (one being killed in the fall).

We are utterly unaware of the qualifications of your author and therefore do not know whether he is or is not a student of nature. Nevertheless as one who has lived for twenty-six years past in Northern Alberta where the Canada geese breed annually; and as one who has actually and repeatedly raised Canada geese; as well as having had ample opportunity to see them in their nesting grounds year after year, when mating, nesting, hatching and rearing their young, there may be some slight justification on our part, for scouting author Wood's statement of the Canada geese taking to the tall timbers to do their nesting.

Hundreds of thousands of American and Canadian children (and grown-ups) who have not the opportunity to contradict, should not, by what are generally accepted as reliable publications, be led to believe that the Canada geese, or any other geese (or ducks)—save for two types of ducks) nest in tall trees or any kind of trees. Dissemination of such false and harmful statements is indeed very wrong. It is my humble opinion you will hasten to correct these "authentic" impressions.

In closing may I ask author Kerry Wood to give me as near as possible the location in Western Canada where these Canada Geese nested 40 feet above the ground in a tree? If the location is within a thousand miles of us, I can assure the author, I shall hasten there this season to watch the sight and the site—yes, I shall proceed to the very tree. Being the

tallest one on the island it should not be impossible to locate; and in any event I get about the bush with little difficulty, being quite familiar with a large area of Alberta's woodlands. Possibly I can interest Grey Owl in accompanying me.

Yours for accuracy toward our youth.

I am,
HARRY A. WHITE.

Mundare, Alberta.

* * *

Dear Sir:

Your letter of March 31st, addressed to the Editor of NATURAL HISTORY MAGAZINE, has been forwarded to me, and I note your somewhat violent objections to my writings about the Canada Geese nesting in a Red-tail Hawk's nest 40 feet up from the ground.

It was my belief that this habit of the geese was well known to naturalists in Western Canada. I refer you to P. A. Taverna's work, "Birds of Western Canada," published as a Victoria Museum Bulletin, and page 105, case number 172, "Canada Geese, (including Hutchins', Cackling, and White-Cheeked Geese)." The paragraph headed, "Nesting," I quote in full: "On the ground in the grass, on hummocks and elevations like old haystacks, or occasionally in deserted Hawk nests in the tops of tall trees." This bulletin was published in 1926. In Mr. Taverna's more recent work, "Birds of Canada," same bulletin series, published in 1934, the same description of the nesting habits of Canada Geese is printed on page 78. As you doubtless know, Mr. Taverna is Chief Ornithologist for the Victoria Museum, which is the largest institution of its kind in Canada and is supported by the Dominion Government.

I may also refer you to that eminent zoologist, Dr. Wm. Rowan, who holds the chair in that science at the University of Alberta. Doctor Rowan is recognized as a world authority on birds, and he is a thorough and cautious scientist who takes care not to stray from the true facts of natural history. In his weekly talk over the Canadian Broadcasting Commission's Western Network, at 11 p.m. on April 4, 1938, Doctor Rowan, taking as his topic the nesting habits of birds, mentioned that several varieties of ducks and geese occasionally nested in trees, adding that the latter birds, the geese, commonly used hawk nests for home-sites when they did nest in trees. If my memory serves me correctly, he also states that the distance of such nests up from the ground was occasionally in excess of 50 feet.

All the facts for my story were gained from personal observation of a pair of Canada Geese that nested near the town of Red Deer in 1929. The island chosen for the first site of their nest is located on the Red Deer River about half a mile above the estuary of the Indian School Creek, some five and a half miles upstream from the town of Red Deer. When the river flood washed away this nest,

the geese took over a Red-tail Hawk nest on the mainland about half a mile downstream from the Indian School Creek estuary, on the north bank of the Red Deer River, and after the young were reared from the nest, moved them back to the island. For convenience in the story I located the nest tree in question on the island, but this small alteration does not interfere with any of the natural history facts of the case. I have seen and heard of several instances of Canada Geese nesting in hawk nests, and am surprised that you, with your twenty-six years acquaintance with the bird, have not come across a parallel case.

I am sorry that you feel that the story may mislead readers about the habits of Canada Geese. Of course, I am fully aware that humans often misinterpret the behavior of birds and animals, reading too much human psychology into their actions, but to the best of my ability my story-article on the Canada Geese, as used by NATURAL HISTORY MAGAZINE and reprinted by the *Reader's Digest*, was as true an account of their habits during their summer nesting season as I could give from the data gathered.

Should you care to come to Red Deer, I will be pleased to show you the particular hawk tree used by the geese nine years ago. Red-tail hawks have made use of the old nest in the succeeding years.

I would very much like to meet Grey Owl, should you be able to induce him to come to Red Deer. But I must say that I will be very much surprised if a naturalist of Grey Owl's* standing is not familiar with this nesting habit of the Canada Geese.

Yours truly,
KERRY WOOD.

Red Deer, Alberta, Canada.

* * *

Sirs:

Referring to page 281, April, 1938, NATURAL HISTORY, did not Spain choose the Pomegranate as its emblem after the capture of Granada because "granada" is Spanish for Pomegranate?

MRS. H. F. DEVERELL.
Cleveland, Ohio.

This explanation is likely though not incontrovertible. The name Granada is sometimes derived from *granada*, a pomegranate, in allusion to the abundance of pomegranate trees in the neighborhood. The Moors, on the other hand, called Granada *Karnattah* or *Karnattah-al-Yahud*, which is possibly composed of the Arabic words *kurn*, "a hill," and *nattah*, "stranger"—the "city" or "hill of strangers."—ED.

*Nature lovers the world over regret the passing of Grey Owl on April 13, 1938.

SCIENCE IN THE FIELD AND IN THE LABORATORY— *Stowaways on Exhibit—Travel Traits of Tortoises—Crater Mystery Solved— Return of British Guiana Expedition—Garden Visits*

Stowaways on Exhibit

A new exhibit of animals that "hitched" to New York via banana boats from southern ports is on display in the Eighth Avenue subway entrance of the Roosevelt Memorial Hall at the American Museum. In special small habitat groups prepared by artists of the Works Progress Administration, an opossum, a boa constrictor and a gecko lizard are shown creeping or crawling about in settings which depict a small part of their original background. These animals illustrate how many types of animal life can be carried about the world unintentionally by ships. If the banana boats had unloaded their cargoes in Porto Rico instead of in New York, possibly a large number of reptiles and amphibians in the cargo could have survived and made a new colony. These specimens represent only a part of a collection which has recently come to New York in banana shipments and were presented to the Museum by John H. Hart and Louis Brody of the Fruit Dispatch Company.

Snakes and Tortoises of the Southwest

How much heat can a lizard stand? How far can a tortoise travel? Is the Arizona Leaf-nosed Snake a member of a new species of snake? To answer these questions Dr. C. M. Bogert of the Museum Department of Herpetology, accompanied by Mrs. Bogert and Miss Margaret Work of the Department of Entomology are now conducting field operations in the Colorado Desert near Salton Sea. Much of their work is being done at night because many of the desert snakes are nocturnal which is the chief reason why there is so large a number of "rare" species among them. Equipped with flashlights or with headlights from the automobile, the Bogerts are concentrating their collecting efforts on the discovery of the leaf-nosed snake, a burrowing species with a remarkable snout development. Fewer than a dozen specimens of this snake have come to light so far, all of which have been males. At least a single female is required to establish the validity of its status as a distinct species.

The tortoises under investigation are part of a group which was turned lose on the Mojave Desert near Lovejoy Springs in July, 1931. Each tortoise was carefully measured and marked with a metal tag stamped with a number for future identification. The purpose of this experiment was to learn the extent of the tortoises' wanderings and to learn the rate of growth under normal conditions in the field. Four tortoises have already been recovered—all within a few hundred yards of their place of liberation. According to the metal tag, one of these had evidently taken four years to get that far.

The Museum expedition is trying to find others of the same group.

The thermal death point of tortoises as well as that of lizards are being studied. Preliminary investigations have indicated that lizards cannot remain in the direct sun for periods of more than twenty minutes. Aside from this work, Mrs. Bogert is assembling a collection of spiders and Miss Work a collection of moths and other Lepidoptera for the Museum.

Crater Mystery Solved

The acquisition by the Hayden Planetarium of three pieces of meteoric iron from the Estonian craters, which readers of *Natural History* will remember were discussed by Dr. Clyde Fisher in a previous issue*, has enabled scientists to establish that these giant craters were definitely caused by the impact of meteorites rather than by volcanic upheavals. There are six of these craters on the Island of Saaremaa in the Baltic Sea and they cover an area of about 250 acres. The largest is about 400 feet across and some 50 feet deep. When the meteorite—or more likely several meteorites, grouped together like grape-shot—smashed into the glacial drift which covered this part of the world some 2000 years ago, there must have been a blinding flash, a terrific explosion and a violent concussion, since it is estimated that the meteorites struck at tremendous speed. Some of the fragments probably fell back into the craters after the explosion, while others were scattered over the immediate vicinity. The reason no fragments have been found on the surface of the craters or on the ground is probably due to the fact that they were picked up many centuries ago by the Vikings and possibly turned into swords or spears.

Ivan Reinvald, Inspector of Mines of Estonia, discovered these pieces of meteoric iron which have been the object of his solitary investigations for the past 11 years. "It is interesting to note," he writes in the April issue of *Sky*, the magazine of the Hayden Planetarium, "that in investigating one hole there was found an ancient bronze ring which proves to be puzzling to archaeologists. If its age can be determined, it will doubtless throw light on the age of the craters."

Terry-Holden British Guiana Expedition

After six months in the jungle interior of British Guiana and Brazil, Dr. William Hall Holden, leader of the Terry-Holden Expedition, returned to the United States on April 10th, accompanied by Mr. William G. Hassler, Expedition photographer. Doctor Holden was able to make extensive medical research and collected data never before obtained about the primitive Indians deep in the interior.

*November, 1936.

To his knowledge, this has been the first expedition to have made a trip from Georgetown to the Amazon by way of the Sierra Acari Mountains. In the Amazon watershed region they found small villages inhabited by the Wei Wei Indians who are entirely uncivilized but friendly. Here Mr. Hassler took some of the 15,000 feet of motion picture films which the expedition has brought back. Mr. Robert Snediger of the Herpetology Department, together with Dr. A. C. Smith, Associate Curator of the New York Botanical Gardens, who were also on the expedition, are remaining in the field about the mouth of the Rupununi River and the Kanaku Mountains to make further collections.

School Nature League News

A glimpse of the spring countryside near New York, small in scale, but authentic, with living plants and animals is on exhibition under the auspices of the School Nature League at P. S. 91, 198 Forsyth Street (Manhattan—Delancy Street subway stop). Open free to the public from May 2 through May 6, this exhibit is the 95th to be run in New York City public schools in cooperation with the League. This organization conducts a Model Nature Room in the Museum, on the second floor of the Education Building, which is open to visitors throughout the year except in July and August.

Other activities sponsored by the School Nature League during May are the trips to outstanding gardens both in and outside of the city. On May 16 and 19 New York City gardens will be visited and on May 25 the gardens of Mr. and Mrs. Marshall Field at Lloyd's Neck, Long Island and of Mrs. John Pratt at Glen Cove, Long Island. Tickets may be obtained from Mrs. Howard Culmann, 2 East 56th Street—Plaza 3-7100 (from 10 A. M. to 1 P. M.).

John Burroughs Medal

The annual meeting of the John Burroughs Association was held at The American Museum of Natural History, New York, on April 2, 1938, some four hundred members and guests attending. The Burroughs Medal, which may be struck each year to commemorate a work of foremost literary distinction in the field of natural history, was conferred upon Dr. Robert Cushman Murphy in recognition of his two-volume monograph, "Oceanic Birds of South America," which was published by the American Museum in 1936. The same book had already been honored, last November, by the award to its author of the Brewster Medal of the American Ornithologists' Union.

The presentation of the Burroughs Medal was made by Dr. Clyde Fisher, Curator of the Hayden Planetarium. Doctor Murphy is the tenth medalist of the

Burroughs Association. Earlier recipients have included William Beebe, Ernest Thompson Seton and Frank M. Chapman.

Marine Invertebrates from the Philippines

The collections of the Department of Living Invertebrates of the Museum have been increased by the addition of a large series of specimens obtained by Dr. Willard G. Van Name of that Department, who has recently returned from a trip of about six months duration to the Philippines and Dutch East Indies which he made with the aid of a travel grant from the Carnegie Corporation of New York. Doctor Van Name visited the museums and scientific institutions of these islands for the purpose of getting first-hand information of their work, methods and equipment and of the opportunities for cooperation between them and the American Museum. He made collections principally in two regions in the Philippines:—the west coast of the Gulf of Davao, on Mindanao and at Puerto Galera, on Mindoro, where the Philippine Government has a biological station.

Marine life of the coral reefs of the East Indian region of which the Philippines are one of the important parts, is the richest in the world, greatly exceeding that of the American Tropics in respect to the number of species and in the brilliant and varied coloration that many of them exhibit, but up to the present time this fauna has been poorly represented in the American Museum, so that these specimens fill a real deficiency.

Return of the Phelps Venezuela Expedition

With 2000 birds, 500 mammals, an assortment of lower vertebrates and invertebrates and a substantial botanical collection to its credit, the Phelps Venezuela Expedition sponsored by Mr. W. H. Phelps, Caracas, and headed by Dr. G. H. H. Tate has concluded in three and

one-half months an entirely successful undertaking to the little-known highlands of Venezuelan Guiana. The existence of Mount Auyan-tepui in a region heretofore shown on published maps as of comparatively slight elevation was unknown to Museum authorities until a few months before the expedition took the field. Auyan-tepui has been found to be a vast elevated plateau of sandstone, 300 square miles in area and reaching 8000 feet above sea level. Its fauna and flora are obviously closely related to those of Mount Roraima, 100 miles east-southeast.

This was an aviation expedition par excellence. Doctor Tate flew from New York to Venezuela and the entire party was conveyed in one of the newest Lockheed planes from Ciudad Bolivar to a savanna within a mile or so of the foot of Auyan-tepui.

Other members of the Museum staff to accompany the expedition were W. F. Coultaas, formerly in charge of the Whitney South Seas Expedition; E. T. Gilliard, Department of Ornithology, and J. A. Dillon, Department of Preparation.

Russian Easter Eggs

During the Easter season the Department of Minerals & Gems exhibited in the main foyer a Collection of Russian Easter Eggs. The plain carved eggs fashioned from the ornamental stones of Russia are well represented in the Morgan Collection, from which most of the pieces constituting the exhibit were taken. A generous loan from the Hammer Galleries, Inc., enabled the Department to supplement these plainer examples of nineteenth century Russian lapidary work with a notably elaborate and richly embellished Easter egg given by the Emperor Alexander III to the Empress on Easter, 1894, and one in the form of a pendant also received at Easter by a member of the Romanoff family. Both of these pieces were designed and executed by Carl Fabergé, the court jeweler.

GREEN GOLD

Continued from page 343

many ways in which science is put to work for social improvement. Paging back through storied North America, through the era of discovery, through the adventures of emigration, the pressure of industrialism, and the age of science—every change was part of the forest epic.

Men came sailing over far seas in cockleshell frigates; lone trappers braved the wilderness; men, women and beasts set forth in caravans, toiling on day after day, month after month, hub-deep in dust and mud, until the last mountain was crossed, the last forest penetrated. For above the American forests the pioneers saw the kindling stars of success.

Man has always pushed back forests. In the past his greeting to the noble forests has always been "Hail and Farewell." Now come the modern pioneers! They glimpse above the forest the high star of human values, and will write a new page of the forest epic—a page about "forests everlasting."

A ROUND TRIP TO DAVY JONES' LOCKER

Continued from page 361

out to "haul" swordfish should have in every dory a bushel basket in which to coil the line as it comes in. When he had sufficiently recovered, I surely gave him *h—l* for failing to obey instructions. He probably owes his life to the fact that Doctor Stetson was on board *Buckaroo* and could direct first aid artificial respiration. As it was, Pratt surely had a close shave.

In 23 years' swordfishing experience in which I have myself harpooned over 500 fish, this is the first accident of this particular kind that I have ever had happen to any of my men. In fact I have never known of a like accident. Why such has never happened before is, however, rather remarkable, seeing how carelessly some dorymen loosely coil the rope in the bottom of the boat near their feet. But in Pratt's case all's well that ends well; however, he takes the basket with him nowadays.

WHAT TO DO ABOUT IT?

I'VE BEEN ALL OUT OF SORTS LATELY. SOMEHOW SO MANY THINGS GET ON MY NERVES THAT NEVER USED TO!

I KNOW JUST WHAT YOU NEED, MARGARET! A RESTFUL, ENTERTAINING TRIP TO THE WEST!

OH! I'D REALLY LOVE IT! BUT I DON'T SEE HOW I CAN AFFORD IT THIS YEAR NONSENSE! YOU CAN AFFORD IT IF I CAN... I'VE BEEN OFTEN AND THE COST IS SO VERY LOW WHEN ROCK ISLAND ARRANGES IT FOR YOU... AND THEY TAKE YOU TO THE GRANDEST PLACES!

See the Wonders of the WEST...

True—there are grand places to visit via Rock Island—California, Colorado, Yellowstone, Yosemite, Carlsbad Caverns, Rocky Mountain National Park. True, too, your budget can be your guide to expenditures—you'll have a grand trip at lowest cost.

The De Luxe Golden State Limited or Luxury-Economy Californian will take you from Chicago to California—the Rocky Mountain Limited to Colorado. All trains air-conditioned.

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Rock Island has arranged truly economical all-expense tours for this Summer—especially popular because of the added opportunities they afford for carefree enjoyment. They include most of the places you've long wished to visit. Ask about them.

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ROUTE OF THE ROCKETS



Who , When , Where

MAY CALENDAR OF ENTERTAINMENT

On these pages will be found a calendar of museum events in metropolitan New York for May. It is hoped that this list will enable those at a distance who contemplate a visit to New York to plan more efficiently, and that those who live in or near the city may be able to choose lectures and other activities that fit their needs or interests.

CHARLES RUSSELL

Curator of the Department of Education, American Museum of Natural History

General Information

AMERICAN MUSEUM OF NATURAL HISTORY

Central Park West at 79th Street,
New York City
Hours: Daily 9:00 a. m. to 5:00 p. m. Sunday
1:00 p. m. to 5:00 p. m. Open holidays 9:00
a. m. to 5:00 p. m. Admission Free.

AQUARIUM

Battery Park, New York City
Hours: Daily 9:00 a. m. to 5:00 p. m. Admis-
sion Free.

BROOKLYN BOTANIC GARDEN

1000 Washington Avenue,
Brooklyn
Hours: Daily from 9:00 a. m. until dark. Sun-
days from 10:00 a. m. Conservatories open from
10:00 a. m. until 4:00 p. m. Admission Free.

BROOKLYN MUSEUM

Eastern Parkway and Washington Avenue,
Brooklyn
Hours: Daily 10:00 a. m. to 5:00 p. m. Satur-
days and holidays 10:00 a. m. to 6:00 p. m.
Sundays 2:00 p. m. to 6:00 p. m.
Admission Free, except Mondays and Fridays,
when charge is 25¢ for adults and 10¢ for
children.

FRICK COLLECTION

1 East 70th Street, New York City
Hours: Weekdays 10:00 a. m. to 5 p. m.
Admission Free.

METROPOLITAN MUSEUM OF ART

Fifth Avenue and 82nd Street,
New York City
Hours: Daily 10:00 a. m. to 5:00 p. m. Satur-
days and holidays 10:00 a. m. to 5:00 p. m.
Sundays 1:00 p. m. to 5:00 p. m.
Admission Free, except Mondays and Fridays,
when charge is 25¢.

MUSEUM OF THE AMERICAN INDIAN

Broadway and 155th Street
New York City
Hours: Weekdays 2:00 p. m. to 5:00 p. m. Ad-
mission Free.

MUSEUM OF THE CITY OF NEW YORK

Fifth Avenue and 103rd Street,
New York City
Hours: Daily 10:00 a. m. to 5:00 p. m. Satur-
days and holidays 10:00 a. m. to 6:00 p. m.
Sundays 1:00 p. m. to 6:00 p. m. Closed Tues-
days. Admission Free, except Monday, when
charge is 25¢.

MUSEUM OF MODERN ART

11 West 53rd Street, New York City
Hours: Daily 10:00 a. m. to 6:00 p. m.
Sundays 12:00 m. to 6:00 p. m.
Admission Free on Monday, other days 25¢.

MUSEUM OF SCIENCE AND INDUSTRY

RCA Building, Radio City, New York City
Hours: Daily 10:00 a. m. to 5:00 p. m. Sun-
days 2:00 p. m. to 5:00 p. m. Admission 25¢.
(Free to teachers with classes.)

NEW YORK BOTANICAL GARDEN

Bronx Park, Bronx, N. Y.
Hours: Museum and Conservatories open daily
10:00 a. m. to 4:30 p. m. Admission Free.

STATEN ISLAND MUSEUM

Stuyvesant Place and Wall Street,
St. George, Staten Island
Hours: Daily 10:00 a. m. to 5:00 p. m. Sunday
2:00 p. m. to 5:00 p. m. Admission Free.

WHITENEY MUSEUM OF AMERICAN ART

8-12 West 8th Street, New York City
Hours: Daily 10:00 a. m. to 6:00 p. m. Sunday
2:00 p. m. to 6:00 p. m. Closed Monday. Ad-
mission Free.

MAY 1

BROOKLYN MUSEUM

2:30 p. m.—Organ Recital by Robert Bedell—
Sculpture Court—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Tour—"Furniture: the Period of
Louis XVI and Adam" by Miss Bradish—Main
Hall—Open to Public.

2:30 p. m.—Motion Picture—"The Pottery
Maker; Peter Stuyvesant (Yale Chronicles of
America Photoplay)"—Lecture Hall—Open to
Public.

3:00 p. m.—Lecture—"Color in Flower Arrange-
ment" by Miss Cornell—Classroom K—Open to
Public.

3:15 p. m.—Tour—"American Furnishings in
the Federal Period," by Miss Bradish—Main
Hall—Open to Public.

MAY 3

AMERICAN MUSEUM OF NATURAL HISTORY

3:50 p. m.—Lecture—"Geographical Distribution
of Animals" by Agnes K. Saunders—Auditorium—
Open to Public.

METROPOLITAN MUSEUM OF ART

11 a. m.—Lecture—"Color in Painting II" by
Miss Cornell—Classroom K—Open to Public.
2:30 p. m.—Motion picture—"The Temples and
Tombs of Ancient Egypt; Digging into the Past"
—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Design in Dress Fabrics"
by Miss Cornell—Classroom K—Open to Public.
4:00 p. m.—Lecture—"Puppets and Plays" by
Miss Duncan—Main Hall—Open to Public.

MAY 4

AMERICAN MUSEUM OF NATURAL HISTORY

4:10 p. m.—Lecture—"Bird Migration," by
Farida Wiley—Open to Members.

S P E C I A L E X H I B I T S

Sun-dials, telescopes, geyser models, and
the inside of the atom—these are a few
of the exhibits prepared by elementary
junior and high school students in
and around New York City, which will be
on display in the tenth Annual School
Science Fair in Education Hall of the
Museum, May 8-12.

As an outlet for the creative efforts of
young amateur photographers in the New
York City high schools, and to acquaint
the public with the work that is being
done by them, the American Institute
is sponsoring the first Scholastic Salon of
Photography at the Museum, Education
Hall, from May 22 to 28.

MAY 5

AMERICAN MUSEUM OF NATURAL HISTORY

8:15 p. m.—The annual James Arthur Lecture
on the Evolution of the Human Brain—Roose-
velt Memorial Lecture Hall—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Chinese Porcelains in
the Collection," by Mr. Fosburgh—Open to
Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"The Late Gothic Pe-
riod," by Mr. Grier—Main Hall—Open to
Public.

MAY 6

AMERICAN MUSEUM OF NATURAL HISTORY

10:30 a. m.—Lecture—"Birds of Spring," by
Farida A. Wiley—Auditorium—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Spanish Painting in the
Collection" by Mr. Ritchie—Open to Public.

MAY 7

AMERICAN MUSEUM OF NATURAL HISTORY

10:30 a. m.—Motion Picture—"Life of Louis
Pasteur"—Auditorium—Open to Public.
2:00 p. m.—Motion Picture—"Saving Our Wild
Life"—Auditorium—Open to Public.

4:00 p. m.—Lecture—"Famous Diamonds of the
World" by Herbert P. Whitlock—Room 319—
Open to Public.

BROOKLYN MUSEUM

3:00 p. m.—Concert—"New England Sacred and
Secular Music of Revolutionary Days"—Scul-
ture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Dutch Painting in the
Collection" by Mr. Fosburgh—Open to Public.

NATURAL HISTORY, MAY, 1938

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"The Oracle at Delphi" by Mr. Shaw—Lecture Hall—Open to Public.
2:00 p. m.—Lecture—"Bobbin and Needlepoint Lace" by Miss Bradish—Main Hall—Open to Public.
2:30 p. m.—Motion Picture—"The Etcher's Art; Drypoint"—a Demonstration—Lecture Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

1:15 and 3:30 p. m.—Motion Picture—"Electrifying New York"—Open to Public.

NEW YORK BOTANICAL GARDEN

3:00 p. m.—Lecture—"A Summer Program of Plant Protection" by Mr. B. O. Dodge—Open to Public.

MAY 8

BROOKLYN MUSEUM

2:30 p. m.—Organ Recital by Robert Bedell—Sculpture Court—Open to Public.
4:00 p. m.—Concert by Symphony Orchestra—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Jan Vermeer of Delft" by Mr. Fosburgh—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Tour—"Florentine and Central Italian Painting" by Miss Abbot—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"The Making of Wrought Iron; A Visit to the Armor Galleries; Firearms of Our Forefathers"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Garden Design" by Richardson Wright—Classroom K—Open to Public.

3:15 p. m.—Tour—"North Italian and Venetian Painting" by Miss Abbot—Main Hall—Open to Public.

MAY 10

AMERICAN MUSEUM OF NATURAL HISTORY

3:50 p. m.—Motion Picture—"Life of Louis Pasteur"—Auditorium—Open to Public.

8:15 p. m.—Lecture—"Invasion of the Continents by the Life of the Seas" by Roy W. Miner—Roosevelt Memorial Lecture Room—Open to Members.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Color in Painting III" by Miss Cornell—Classroom K—Open to Public.

2:30 p. m.—Motion Picture—"Columbus (Yale Chronicles of America Photoplay)"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Design in Jewelry" by Miss Cornell—Classroom K—Open to Public.

4:00 p. m.—Lecture—"Rugs and Symbols" by Miss Duncan—Main Hall—Open to Public.

MAY 11

AMERICAN MUSEUM OF NATURAL HISTORY

4:10 p. m.—Lecture—"Fresh-Water Life" by Mrs. Saunders—Open to Members.

FRICK COLLECTION

3:00 p. m.—Lecture—"Duccio and the Altarpiece for Siena Cathedral" by Mr. Fosburgh—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Changes in Taste" by Mr. Taggart—Main Hall—Open to Public.

4:00 p. m.—Lecture—"The Private Life of a Phoenix" by Georg Steindorff—Classroom A—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

3:30 p. m.—Motion Picture—"A Highway to the Sea"—Open to Public.

MAY 12

FRICK COLLECTION

3:00 p. m.—Lecture—"Limoges Enamels in the Collection" by Mr. Ritchie—Open to Public.

MAY 13

AMERICAN MUSEUM OF NATURAL HISTORY

10:30 a. m.—Lecture—"Modern Explorers" by George Minot—Auditorium—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"The Giorgionesque Mood" by Mr. Fosburgh—Open to Public.

MAY 11

AMERICAN MUSEUM OF NATURAL HISTORY

2:00 p. m.—Motion Picture—"Jamestown" Auditorium—Open to Public.
4:00 p. m.—Lecture—"Jade: Its Carving, Mythology, and Symbolism" by Herbert P. Whitehead—Room 319—Open to Public.

BROOKLYN MUSEUM

2:00 p. m.—Lecture—"History of Music and Its Parallel in Visual Art: The Classical Style" by David LeVita—Classroom A—Open to Public.
3:00 p. m.—Concert—"Popular Songs of Early Days"—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"William Hogarth" by Mr. Ritchie—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"The Hellenistic Period" by Mr. Shaw—Lecture Hall—Open to Public.
2:00 p. m.—Lecture—"Chinese Jades" by Miss Duncan—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"Digging into the Past: The Daily Life of the Egyptians—Ancient and Modern" Lecture Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

1:15 and 3:30 p. m.—Motion Picture—"From Forest to City"—Open to Public.

NEW YORK BOTANICAL GARDEN

3:00 p. m.—Lecture—"Traveling Through Switzerland" by H. N. Moldenke—Open to Public.

PLANETARIUM Schedule for MAY

★

"The Story of The Stars"

Weekdays—2:00, 3:30, and 8:30 P. M.

Saturdays—11:00 A. M., 1:00, 2:00,
3:00, 4:00, 5:00 and 8:30 P. M.

Sundays & Holidays—2:00, 3:00, 4:00,
5:00 and 8:30 P. M.

General Admission Afternoons.....25¢

Reserved Seat ".....50¢

General Admission Evenings.....35¢

Reserved Seat ".....60¢

General Admission for Children under 17, accompanied by an adult, 15¢ at all times. (No reduced price for reserved seats occupied by children.) Children under 5 not admitted. Door charge the hour. Special facilities for the hard of hearing.

MAY 15

BROOKLYN MUSEUM

2:30 p. m.—Organ Recital by Robert Bedell—Sculpture Court—Open to Public.

4:00 p. m.—Concert by Symphony Orchestra—Sculpture Court—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Tour—"Renaissance Paintings in the Altman Collection" by Mrs. Fansler—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"The Making of a Bronze Statue; The Etcher's Art"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Color in Painting," by Miss Cornell—Classroom K—Open to Public.

3:15 p. m.—Tour—"Dutch Paintings in the Altman Collection" by Mrs. Fansler—Main Hall—Open to Public.

MAY 17

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Color in Painting IV" by Miss Cornell—Classroom K—Open to Public.

2:30 p. m.—Motion Picture—"The Making of Wrought Iron; The American Wing"—Lecture Hall—Open to Public.

3:00 p. m.—Lecture—"Design in Lace" by Miss Cornell—Classroom K—Open to Public.

4:00 p. m.—Lecture—"Chinese and European Chinaware," by Miss Duncan—Main Hall—Open to Public.

MAY 18

FRICK COLLECTION

3:00 p. m.—Lecture—"A. E. Housman" by Mr. Ritchie—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"The Art of the Americas" by Mr. Taggart—Main Hall—Open to Public.

4:00 p. m.—Lecture—"Masterpieces of English Portraiture" by George Steindorff—Classroom A—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

1:15 p. m.—Motion Picture—"A Day in Revenue Cutters"—Open to Public.

MAY 19

FRICK COLLECTION

3:00 p. m.—Lecture—"Italian Sculpture in the Collection" by Mr. Fosburgh—Open to Public.

MAY 21

AMERICAN MUSEUM OF NATURAL HISTORY

2:00 p. m.—Motion Picture—"Berber Tribes of North Africa"—Auditorium—Open to Public.

BROOKLYN MUSEUM

3:00 p. m.—Concert—"American Music of 19th Century"—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Giovanni Bellini and the Frick St. Francis" by Mr. Fosburgh—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"Hellenistic Cities" by Mr. Shaw—Lecture Hall—Open to Public.

2:00 p. m.—Lecture—"Art of Mesopotamia" by Mr. Taggart—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"A Visit to the Armor Galleries; Behind the Scenes in the Metropolitan Museum"—Lecture Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

1:15 and 3:30 p. m.—Motion Picture—"Empires of Steel"—Open to Public.

NEW YORK BOTANICAL GARDEN

3:00 p. m.—Lecture—"Showy Flowers of Florida" by H. Beaman Douglass—Open to Public.

MAY 22

BROOKLYN MUSEUM

2:30 p. m.—Organ Recital by Robert Bedell—Sculpture Court—Open to Public.

4:00 p. m.—Concert by Symphony Orchestra—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Titian" by Mr. Fosburgh—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Tour—"Dutch and Flemish Painting before 1550" by Mrs. Fansler—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"Tapestries and How They Are Made; The Making of a Stained Glass Window"—Lecture Hall—Open to Public.

3:15 p. m.—Tour—"Dutch and Flemish Painting after 1550" by Mrs. Fansler—Main Hall—Open to Public.

MAY 24

AMERICAN MUSEUM OF NATURAL HISTORY

8:15 p. m.—Lecture—"Inter-Relationships of Marine Animals" by Roy W. Miner—Roosevelt Memorial Lecture Room—Open to Members.

METROPOLITAN MUSEUM OF ART

2:30 p. m.—Motion Picture—"The Pottery Makers; The Puritans (Yale Chronicles of America Photoplay)"—Lecture Hall—Open to Public.

4:00 p. m.—Lecture—"Sash and Sleeve Trinkets" by Miss Duncan—Main Hall—Open to Public.

MAY 25

FRICK COLLECTION

3:00 p. m.—Lecture—"The Venetian Decorative Painters" by Mr. Fosburgh—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"American Sculptors" by Mr. Taggart—Main Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

3:30 p. m.—Motion Picture—"A Modern Gas Plant"—Open to Public.

MAY 26

FRICK COLLECTION

3:00 p. m.—Lecture—"Spanish Painting in the Collection" by Mr. Ritchie—Open to Public.

MAY 27

AMERICAN MUSEUM OF NATURAL HISTORY
10:30 a. m.—Motion Picture—"Sequoia"—Auditorium—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Francesco Laurana" by Mr. Fosburgh—Open to Public.

MAY 28

AMERICAN MUSEUM OF NATURAL HISTORY
2:00 p. m.—Motion Picture—"Sequoia"—Auditorium—Open to Public.

BROOKLYN MUSEUM

2:00 p. m.—Lecture—"History of Music and Its Parallels in Visual Art—The Romantic Style" by David LeVita—Classroom A—Open to Public.

3:00 p. m.—American Dance Revue—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"William Blake" by Mr. Ritchie—Open to Public.

METROPOLITAN MUSEUM OF ART

11:00 a. m.—Lecture—"The Sanctuary at Delos" by Mr. Shaw—Lecture Hall—Open to Public.

2:00 p. m.—Lecture—"Late Gothic Sculpture" by Mr. Grier—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"Dixie (Yale Chronicles of America Photoplay); The Making of Wrought Iron"—Lecture Hall—Open to Public.

MUSEUM OF THE CITY OF NEW YORK

1:15 and 3:30 p. m.—Motion Picture—"Eve of the Revolution"—Open to Public.

NEW YORK BOTANIC GARDEN

3:00 p. m.—Lecture—"Lilies for Gardens" by A. B. Stout—Open to Public.

MAY 29

BROOKLYN MUSEUM

2:30 p. m.—Organ Recital by Robert Bedell—Sculpture Court—Open to Public.

4:00 p. m.—Concert by Symphony Orchestra—Sculpture Court—Open to Public.

FRICK COLLECTION

3:00 p. m.—Lecture—"Turner and Constable" by Mr. Ritchie—Open to Public.

METROPOLITAN MUSEUM OF ART

2:00 p. m.—Tour—"English and American Painting before 1850" by Miss Abbot—Main Hall—Open to Public.

2:30 p. m.—Motion Picture—"Diggings into the Past; The Daily Life of the Egyptians—Ancient and Modern"—Lecture Hall—Open to Public.

3:15 p. m.—Tour—"American Painting after 1850" by Miss Abbot—Main Hall—Open to Public.

MAY 30

METROPOLITAN MUSEUM OF ART

2:30 p. m.—Motion Picture—"Tapestries, and How They Are Made; The Making of a Stained-Glass Window"—Lecture Hall—Open to Public.

GUIDE SERVICE

The following institutions offer free lecture tours of their collections:

AMERICAN MUSEUM OF NATURAL HISTORY
Wednesdays, Fridays and Saturdays at 11:00 a. m. and 3:00 p. m. Meeting Place: 2nd Floor, Roosevelt Memorial.

METROPOLITAN MUSEUM OF ART
Wednesdays and Thursdays at 2:00 p. m.; Tuesdays at 12:00 m. Meeting Place: Main Hall.

MUSEUM OF MODERN ART
Daily at 11:00 a. m., 1:30 p. m., 3:00 p. m., and 4:30 p. m.

MAY RADIO PROGRAMS

EVERY DAY

10:00 a. m.—Organ Recital—Station WNYC BROOKLYN MUSEUM.

MAY 2

5:45 p. m.—"New Horizons"—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 4

3:30 p. m.—"Music of the Spheres" by Marian Lockwood—Station WQXR—HAYDEN PLANETARIUM.

5:45 p. m.—"Exploring Space"—Columbia Broadcasting System (coast to coast network)—HAYDEN PLANETARIUM.

MAY 5

11:30 a. m.—"Deep Sea Fishes" by John Saunders—Station WHN—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 6

4:30 p. m.—"Today's Natural History" by Robert Coles—Station WNYC—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 7

12 m.—"This Wonderful World" (Question and Answer Program)—Station WOR—HAYDEN PLANETARIUM.

MAY 9

5:45 p. m.—"New Horizons" Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 11

3:30 p. m.—"Music of the Spheres" by Marian Lockwood—Station WQXR—HAYDEN PLANETARIUM.

5:45 p. m.—"Exploring Space"—Columbia Broadcasting System (coast to coast network)—HAYDEN PLANETARIUM.

MAY 12

11:30 a. m.—"Historic Animals" by John Saunders—Station WHN—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 13

3:15 p. m.—"Planting Annuals" by Montague Free—Station WNYC—BROOKLYN BOTANIC GARDEN.

4:30 p. m.—"Today's Natural History" by Robert Coles—Station WNYC—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 14

12 m.—"This Wonderful World" (Question and Answer Program)—Station WOR—HAYDEN PLANETARIUM.

MAY 16

5:45 p. m.—"New Horizons"—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 18

3:30 p. m.—"Music of the Spheres" by Marian Lockwood—Station WQXR—HAYDEN PLANETARIUM.

5:45 p. m.—"Exploring Space"—Columbia Broadcasting System (coast to coast network)—HAYDEN PLANETARIUM.

MAY 19

11:30 a. m.—"The Story of the Cat" by John Saunders—Station WHN—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 20

4:30 p. m.—"Today's Natural History" by Robert Coles—Station WNYC—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 21

12 m.—"This Wonderful World" (Question and Answer Program)—Station WOR—HAYDEN PLANETARIUM.

MAY 23

5:45 p. m.—"New Horizons"—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 25

3:30 p. m.—"Music of the Spheres" by Marian Lockwood—Station WQXR—HAYDEN PLANETARIUM.

5:45 p. m.—"Exploring Space"—Columbia Broadcasting System (coast to coast network)—HAYDEN PLANETARIUM.

MAY 26

11:30 a. m.—"Famous Naturalists" by John Saunders—Station WHN—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 27

3:15 p. m.—"What to See Now at the Brooklyn Botanic Garden"—Arthur Harcourt Graves—Station WNYC—BROOKLYN BOTANIC GARDEN.

4:30 p. m.—"Today's Natural History" by Robert Coles—Station WNYC—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 29

12 m.—"This Wonderful World" (Question and Answer Program)—Station WOR—HAYDEN PLANETARIUM.

MAY 30

5:45 p. m.—"New Horizons"—Columbia Broadcasting System (coast to coast network)—AMERICAN MUSEUM OF NATURAL HISTORY.

MAY 31

2:15 p. m.—"Spring Flowers—Their Stories," by Montague Free—Station WOR—BROOKLYN BOTANIC GARDEN.

Note: All times referred to in Radio Programs are Eastern Daylight Saving Time.

